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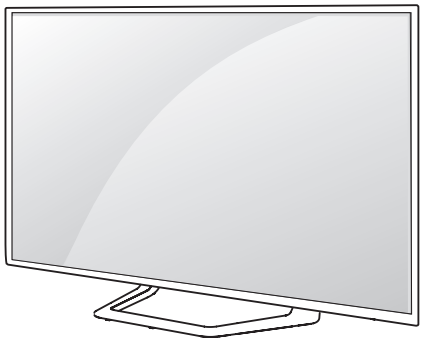
LED LCD TV
SERVICE MANUAL

CHASSIS : LD22E

MODEL : 32LM640S/640T

32LM640S/640T-ZA

CAUTION
BEFORE SERVICING THE CHASSIS,
READ THE SAFETY PRECAUTIONS IN THIS MANUAL.



P/NO : MFL67360924 (1207-REV00)

Printed in Korea

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SAFETY PRECAUTIONS

IMPORTANT SAFETY NOTICE

Many electrical and mechanical parts in this chassis have special safety-related characteristics. These parts are identified by ⚠ in the Schematic Diagram and Exploded View.
It is essential that these special safety parts should be replaced with the same components as recommended in this manual to prevent Shock, Fire, or other Hazards.
Do not modify the original design without permission of manufacturer.

General Guidance

An **isolation Transformer should always be used** during the servicing of a receiver whose chassis is not isolated from the AC power line. Use a transformer of adequate power rating as this protects the technician from accidents resulting in personal injury from electrical shocks.

It will also protect the receiver and it's components from being damaged by accidental shorts of the circuitry that may be inadvertently introduced during the service operation.

If any fuse (or Fusible Resistor) in this TV receiver is blown, replace it with the specified.

When replacing a high wattage resistor (Oxide Metal Film Resistor, over 1 W), keep the resistor 10 mm away from PCB.

Keep wires away from high voltage or high temperature parts.

Before returning the receiver to the customer,

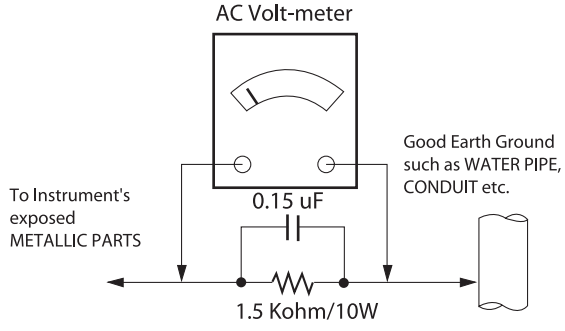
always perform an **AC leakage current check** on the exposed metallic parts of the cabinet, such as antennas, terminals, etc., to be sure the set is safe to operate without damage of electrical shock.

Leakage Current Cold Check(Antenna Cold Check)
With the instrument AC plug removed from AC source, connect an electrical jumper across the two AC plug prongs. Place the AC switch in the on position, connect one lead of ohm-meter to the AC plug prongs tied together and touch other ohm-meter lead in turn to each exposed metallic parts such as antenna terminals, phone jacks, etc.
If the exposed metallic part has a return path to the chassis, the measured resistance should be between 1 MΩ and 5.2 MΩ.
When the exposed metal has no return path to the chassis the reading must be infinite.
An other abnormality exists that must be corrected before the receiver is returned to the customer.

Leakage Current Hot Check (See below Figure)
Plug the AC cord directly into the AC outlet.

Do not use a line Isolation Transformer during this check.
Connect 1.5 K / 10 watt resistor in parallel with a 0.15 uF capacitor between a known good earth ground (Water Pipe, Conduit, etc.) and the exposed metallic parts.
Measure the AC voltage across the resistor using AC voltmeter with 1000 ohms/volt or more sensitivity.
Reverse plug the AC cord into the AC outlet and repeat AC voltage measurements for each exposed metallic part. Any voltage measured must not exceed 0.75 volt RMS which is corresponds to 0.5 mA.
In case any measurement is out of the limits specified, there is possibility of shock hazard and the set must be checked and repaired before it is returned to the customer.

Leakage Current Hot Check circuit



When 25A is impressed between Earth and 2nd Ground for 1 second, Resistance must be less than 0.1 Ω
*Base on Adjustment standard

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SERVICING PRECAUTIONS

CAUTION: Before servicing receivers covered by this service manual and its supplements and addenda, read and follow the *SAFETY PRECAUTIONS* on page 3 of this publication.
NOTE: If unforeseen circumstances create conflict between the following servicing precautions and any of the safety precautions on page 3 of this publication, always follow the safety precautions. Remember: Safety First.

General Servicing Precautions

1. Always unplug the receiver AC power cord from the AC power source before;
   a. Removing or reinstalling any component, circuit board module or any other receiver assembly.
   b. Disconnecting or reconnecting any receiver electrical plug or other electrical connection.
   c. Connecting a test substitute in parallel with an electrolytic capacitor in the receiver.
   CAUTION: A wrong part substitution or incorrect polarity installation of electrolytic capacitors may result in an explosion hazard.
2. Test high voltage only by measuring it with an appropriate high voltage meter or other voltage measuring device (DVM, FETVOM, etc) equipped with a suitable high voltage probe. Do not test high voltage by "drawing an arc".
3. Do not spray chemicals on or near this receiver or any of its assemblies.
4. Unless specified otherwise in this service manual, clean electrical contacts only by applying the following mixture to the contacts with a pipe cleaner, cotton-tipped stick or comparable non-abrasive applicator; 10 % (by volume) Acetone and 90 % (by volume) isopropyl alcohol (90 % - 99 % strength)
   CAUTION: This is a flammable mixture.
   Unless specified otherwise in this service manual, lubrication of contacts in not required.
5. Do not defeat any plug/socket B+ voltage interlocks with which receivers covered by this service manual might be equipped.
6. Do not apply AC power to this instrument and/or any of its electrical assemblies unless all solid-state device heat sinks are correctly installed.
7. Always connect the test receiver ground lead to the receiver chassis ground before connecting the test receiver positive lead.
   Always remove the test receiver ground lead last.
8. Use with this receiver only the test fixtures specified in this service manual.
   CAUTION: Do not connect the test fixture ground strap to any heat sink in this receiver.

Electrostatically Sensitive (ES) Devices

Some semiconductor (solid-state) devices can be damaged easily by static electricity. Such components commonly are called Electrostatically Sensitive (ES) Devices. Examples of typical ES devices are integrated circuits and some field-effect transistors and semiconductor “chip” components. The following techniques should be used to help reduce the incidence of component damage caused by static by static electricity.

1. Immediately before handling any semiconductor component or semiconductor-equipped assembly, drain off any electrostatic charge on your body by touching a known earth ground. Alternatively, obtain and wear a commercially available discharging wrist strap device, which should be removed to prevent potential shock reasons prior to applying power to the unit under test.
2. After removing an electrical assembly equipped with ES devices, place the assembly on a conductive surface such as aluminum foil, to prevent electrostatic charge buildup or exposure of the assembly.
3. Use only a grounded-tip soldering iron to solder or unsolder ES devices.
4. Use only an anti-static type solder removal device. Some solder removal devices not classified as “anti-static” can generate electrical charges sufficient to damage ES devices.
5. Do not use freon-propelled chemicals. These can generate electrical charges sufficient to damage ES devices.
6. Do not remove a replacement ES device from its protective package until immediately before you are ready to install it. (Most replacement ES devices are packaged with leads electrically shorted together by conductive foam, aluminum foil or comparable conductive material).
7. Immediately before removing the protective material from the leads of a replacement ES device, touch the protective material to the chassis or circuit assembly into which the device will be installed.
   CAUTION: Be sure no power is applied to the chassis or circuit, and observe all other safety precautions.
8. Minimize bodily motions when handling unpackaged replacement ES devices. (Otherwise harmless motion such as the brushing together of your clothes fabric or the lifting of your foot from a carpeted floor can generate static electricity sufficient to damage an ES device.)

General Soldering Guidelines

1. Use a grounded-tip, low-wattage soldering iron and appropriate tip size and shape that will maintain tip temperature within the range or 500 °F to 600 °F.
2. Use an appropriate gauge of RMA resin-core solder composed of 60 parts tin/40 parts lead.
3. Keep the soldering iron tip clean and well tinned.
4. Thoroughly clean the surfaces to be soldered. Use a mall wire-bristle (0.5 inch, or 1.25 cm) brush with a metal handle. Do not use freon-propelled spray-on cleaners.
5. Use the following unsoldering technique
   a. Allow the soldering iron tip to reach normal temperature. (500 °F to 600 °F)
   b. Heat the component lead until the solder melts.
   c. Quickly draw the melted solder with an anti-static, suction-type solder removal device or with solder braid.
   CAUTION: Work quickly to avoid overheating the circuit board printed foil.
6. Use the following soldering technique.
   a. Allow the soldering iron tip to reach a normal temperature (500 °F to 600 °F)
   b. First, hold the soldering iron tip and solder the strand against the component lead until the solder melts.
   c. Quickly move the soldering iron tip to the junction of the component lead and the printed circuit foil, and hold it there only until the solder flows onto and around both the component lead and the foil.
   CAUTION: Work quickly to avoid overheating the circuit board printed foil.
   d. Closely inspect the solder area and remove any excess or splashed solder with a small wire-bristle brush.

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IC Remove/Replacement
Some chassis circuit boards have slotted holes (oblong) through which the IC leads are inserted and then bent flat against the circuit foil. When holes are the slotted type, the following technique should be used to remove and replace the IC. When working with boards using the familiar round hole, use the standard technique as outlined in paragraphs 5 and 6 above.

Removal
1. Desolder and straighten each IC lead in one operation by gently prying up on the lead with the soldering iron tip as the solder melts.
2. Draw away the melted solder with an anti-static suction-type solder removal device (or with solder braid) before removing the IC.

Replacement
1. Carefully insert the replacement IC in the circuit board.
2. Carefully bend each IC lead against the circuit foil pad and solder it.
3. Clean the soldered areas with a small wire-bristle brush. (It is not necessary to reapply acrylic coating to the areas).

"Small-Signal" Discrete Transistor Removal/Replacement
1. Remove the defective transistor by clipping its leads as close as possible to the component body.
2. Bend into a "U" shape the end of each of three leads remaining on the circuit board.
3. Bend into a "U" shape the replacement transistor leads.
4. Connect the replacement transistor leads to the corresponding leads extending from the circuit board and crimp the "U" with long nose pliers to insure metal to metal contact then solder each connection.

Power Output, Transistor Device
Removal/Replacement
1. Heat and remove all solder from around the transistor leads.
2. Remove the heat sink mounting screw (if so equipped).
3. Carefully remove the transistor from the heat sink of the circuit board.
4. Insert new transistor in the circuit board.
5. Solder each transistor lead, and clip off excess lead.
6. Replace heat sink.

Diode Removal/Replacement
1. Remove defective diode by clipping its leads as close as possible to diode body.
2. Bend the two remaining leads perpendicular y to the circuit board.
3. Observing diode polarity, wrap each lead of the new diode around the corresponding lead on the circuit board.
4. Securely crimp each connection and solder it.
5. Inspect (on the circuit board copper side) the solder joints of the two "original" leads. If they are not shiny, reheat them and if necessary, apply additional solder.

Fuse and Conventional Resistor
Removal/Replacement
1. Clip each fuse or resistor lead at top of the circuit board hollow stake.
2. Securely crimp the leads of replacement component around notch at stake top.
3. Solder the connections.
   CAUTION: Maintain original spacing between the replaced component and adjacent components and the circuit board to prevent excessive component temperatures.

Circuit Board Foil Repair
Excessive heat applied to the copper foil of any printed circuit board will weaken the adhesive that bonds the foil to the circuit board causing the foil to separate from or "lift-off" the board. The following guidelines and procedures should be followed whenever this condition is encountered.

At IC Connections
To repair a defective copper pattern at IC connections use the following procedure to install a jumper wire on the copper pattern side of the circuit board. (Use this technique only on IC connections).

1. Carefully remove the damaged copper pattern with a sharp knife. (Remove only as much copper as absolutely necessary).
2. carefully scratch away the solder resist and acrylic coating (if used) from the end of the remaining copper pattern.
3. Bend a small "U" in one end of a small gauge jumper wire and carefully crimp it around the IC pin. Solder the IC connection.
4. Route the jumper wire along the path of the out-away copper pattern and let it overlap the previously scraped end of the good copper pattern. Solder the overlapped area and clip off any excess jumper wire.

At Other Connections
Use the following technique to repair the defective copper pattern at connections other than IC Pins. This technique involves the installation of a jumper wire on the component side of the circuit board.

1. Remove the defective copper pattern with a sharp knife. Remove at least 1/4 inch of copper, to ensure that a hazardous condition will not exist if the jumper wire opens.
2. Trace along the copper pattern from both sides of the pattern break and locate the nearest component that is directly connected to the affected copper pattern.
3. Connect insulated 20-gauge jumper wire from the lead of the nearest component on one side of the pattern break to the lead of the nearest component on the other side.
   Carefully crimp and solder the connections.
   CAUTION: Be sure the insulated jumper wire is dressed so the it does not touch components or sharp edges.

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SPECIFICATION

NOTE : Specifications and others are subject to change without notice for improvement.

1. Application range

This specification is applied to the LCD TV used LD22E chassis.

2. Requirement for Test

Each part is tested as below without special appointment.

1) Temperature: 25 °C ± 5 °C(77 °F ± 9 °F), CST: 40 °C ± 5 °C
2) Relative Humidity: 65 % ± 10 %
3) Power Voltage
   : Standard input voltage (AC 100-240 V~, 50/60 Hz)
   * Standard Voltage of each products is marked by models.
4) Specification and performance of each parts are followed each drawing and specification by part number in accordance with BOM.
5) The receiver must be operated for about 20 minutes prior to the adjustment.

3. Test method

1) Performance: LGE TV test method followed
2) Demanded other specification
   - Safety : CE, IEC specification
   - EMC : CE, IEC
   - Wireless : Wireless HD Specification (Option)

4. Model General Specification

No.	Item	Specification	Remarks
1	Market	EU(PAL Market-36Countries)	**DTV & Analog (Total 37 countries)** **DTV (MPEG2/4, DVB-T) : 30 countries** Germany, Netherland, Switzerland, Hungary, Austria, Slovenia, Bulgaria, France, Spain, Italy, Belgium, Russia, Luxemburg, Greece, Czech, Croatia, Turkey, Moroco, Ireland, Latvia, Estonia, Lithuania, Poland, Portugal, Romania, Albania, Bosnia, Serbia, Slovakia, Beralus **DTV (MPEG2/4, DVB-T2) : 7 countries** UK, Sweden, Denmark, Finland, Norway, Ukraine, Kazakhstan, Ireland **DTV (MPEG2/4, DVB-C) : 37 countries** Germany, Netherland, Switzerland, Hungary, Austria, Slovenia, Bulgaria, France, Spain, Italy, Belgium, Russia, Luxemburg, Greece, Czech, Croatia, Turkey, Moroco, Ireland, Latvia, Estonia, Lithuania, Poland, Portugal, Romania, Albania, Bosnia, Serbia, Slovakia, Beralus, UK, Sweden, Denmark, Finland, Norway, Ukraine, Kazakhstan **DTV (MPEG2/4,DVB-S) : 30 countries** Germany, Netherland, Switzerland, Hungary, Austria, Slovenia, Bulgaria, France, Spain, Italy, Belgium, Russia, Luxemburg, Greece, Czech, Croatia, Turkey, Moroco, Ireland, Latvia, Estonia, Lithuania, Poland, Portugal, Romania, Albania, Bosnia, Serbia, Slovakia, Beralus **Supported satellite : 22 satellites** HISPASAT 1C/1D, ATLANTIC BIRD 2, NILESAT 101/102, ATLANTIC BIRD 3, AMOS 2/3, THOR 5/6, IRIUS 4, EUTELSAT-W3A, EUROBIRD 9°, EUTELSAT-W2A, HOTBIRD 6/8/9, EUTELSAT-SESAT, ASTRA 1L/H/M/KR, ASTRA 3°/3B, BADR 4/6, ASTRA 2D, EUROBIRD 3, EUTELSAT-W7, HELLASSAT 2, EXPRESS AM1, TURKSAT 2°/3°, INTERSAT10

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No.	Item	Specification	Remarks
2	Broadcasting system	1) PAL-BG 2) PAL-DK 3) PAL-I/I' 4) SECAM L/L', DK, BG, I 5) DVB-T 6) DVB-C 7) DVB-T2 8) DVB-S	DVB-S: Satellite
3	Receiving system	Analog : Upper Heterodyne Digital : COFDM, QAM	► DVB-T - Guard Interval(Bitrate_Mbit/s) 1/4, 1/8, 1/16, 1/32 - Modulation : Code Rate QPSK : 1/2, 2/3, 3/4, 5/6, 7/8 16-QAM : 1/2, 2/3, 3/4, 5/6, 7/8 64-QAM : 1/2, 2/3, 3/4, 5/6, 7/8 ► DVB-T2 - Guard Interval(Bitrate_Mbit/s) 1/4, 1/8, 1/16, 1/32, 1/128, 19/128, 19/256, - Modulation : Code Rate QPSK : 1/2, 2/5, 2/3, 3/4, 5/6 16-QAM : 1/2, 2/5, 2/3, 3/4, 5/6 64-QAM : 1/2, 2/5, 2/3, 3/4, 5/6 256-QAM : 1/2, 2/5, 2/3, 3/4, 5/6 ► DVB-C - Symbolrate : 4.0Msymbols/s to 7.2Msymbols/s - Modulation : 16QAM, 64-QAM, 128-QAM and 256-QAM ► DVB-S/S2 - symbolrate DVB-S2 (8PSK / QPSK) : 2 ~ 45Msymbol/s DVB-S (QPSK) : 2 ~ 45Msymbol/s - viterbi DVB-S mode : 1/2, 2/3, 3/4, 5/6, 7/8 DVB-S2 mode : 1/2, 2/3, 3/4, 3/5, 4/5, 5/6, 8/9, 9/10
4	Scart Gender Jack (1EA)	PAL, SECAM	Scart jack is Full scart and support MNT/DTV-OUT (not support DTV Auto AV)
5	Video Input RCA(1EA)	PAL, SECAM, NTSC	4 System : PAL, SECAM, NTSC, PAL60 AV gender jack 1EA
6	Head phone out	Antenna, AV1, AV2, Component, RGB, HDMI1, HDMI2, HDMI3, HDMI4, USB1, USB2, USB3	
7	Component Input (1EA)	Y/Cb/Cr Y/Pb/Pr	Component Gender 1EA
8	RGB Input	RGB-PC	Analog(D-SUB 15PIN)
9	HDMI Input (4EA)	HDMI1-DTV HDMI2-DTV HDMI3-DTV HDMI4-DTV	HDMI4 : PC support(HDMI version 1.3) Support HDCP
10	Audio Input (3EA)	RGB/DVI Audio Component AV	L/R Input
11	SPDIF out (1EA)	SPDIF out	
12	USB (3EA)	EMF, DivX HD, For SVC (download)	JPEG, MP3, DivX HD
13	Ethernet Connect(1EA)	Ethernet Connect	

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5. Component Video Input (Y, CB/PB, CR/PR)

No.	Resolution	H-freq(kHz)	V-freq(Hz)	Porposed
1	720×480	15.73	60.00	SDTV, DVD 480i
2	720×480	15.63	59.94	SDTV, DVD 480i
3	720×480	31.47	59.94	480p
4	720×480	31.50	60.00	480p
5	720×576	15.625	50.00	SDTV, DVD 625 Line
6	720×576	31.25	50.00	HDTV 576p
7	1280×720	45.00	50.00	HDTV 720p
8	1280×720	44.96	59.94	HDTV 720p
9	1280×720	45.00	60.00	HDTV 720p
10	1920×1080	31.25	50.00	HDTV 1080i
11	1920×1080	33.75	60.00	HDTV 1080i
12	1920×1080	33.72	59.94	HDTV 1080i
13	1920×1080	56.250	50	HDTV 1080p
14	1920×1080	67.5	60	HDTV 1080p

6. RGB input (PC)

No.	Resolution	H-freq(kHz)	V-freq.(Hz)	Proposed
1	640 x 350 @70Hz	31.468	70.09	EGA
2	720 x 400 @70Hz	31.469	70.08	DOS
3	640 x 480 @60Hz	31.469	59.94	VESA(VGA)
4	800 x 600 @60Hz	37.879	60.31	VESA(SVGA)
5	1024 x 768 @60Hz	48.363	60.00	VESA(XGA)
6	1152 x 864 @60Hz	54.348	60.053	VESA
7	1360 x 768 @60Hz	47.712	60.015	VESA(WXGA)
8	1920 x 1080 @60Hz	67.5	60.00	WUXGA(Reduced Blanking))

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7. HDMI Input

7.1. DTV mode

No.	Resolution	H-freq(kHz)	V-freq.(kHz)	Proposed
1.	640*480	31.469 / 31.5	59.94/60	SDTV 480P
2.	720*480	31.469 / 31.5	59.94 / 60	SDTV 480P
3.	720*576	31.25	50	SDTV 576P
4.	720*576	15.625	50	SDTV 576I
5.	1280*720	37.500	50	HDTV 720P
6.	1280*720	44.96 / 45	59.94 / 60	HDTV 720P
7.	1920*1080	33.72 / 33.75	59.94 / 60	HDTV 1080I
8.	1920*1080	28.125	50.00	HDTV 1080I
9.	1920*1080	26.97 / 27	23.97 / 24	HDTV 1080P
10.	1920*1080		25	HDTV 1080P
11.	1920*1080	33.716 / 33.75	29.976 / 30.00	HDTV 1080P
12.	1920*1080	56.250	50	HDTV 1080P
13.	1920*1080	67.43 / 67.5	59.94 / 60	HDTV 1080P

7.2. PC mode

No.	Resolution	H-freq(kHz)	V-freq.(Hz)	Proposed
1	640 x 350 @70Hz	31.468	70.09	EGA
2	720 x 400 @70Hz	31.469	70.08	DOS
3	640 x 480 @60Hz	31.469	59.94	VESA(VGA)
4	800 x 600 @60Hz	37.879	60.31	VESA(SVGA)
5	1024 x 768 @60Hz	48.363	60.00	VESA(XGA)
6	1152 x 864 @60Hz	54.348	60.053	VESA
7	1280 x 1024 @60Hz	63.981	60.020	VESA(SXGA)
8	1360 x 768 @60Hz	47.712	60.015	VESA(WXGA)
9	1920 x 1080 @60Hz	67.5	60.00	WUXGA(Reduced Blanking))

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ADJUSTMENT INSTRUCTION

1. Application Range

This specification sheet is applied to all of the LED LCD TV with LD22E chassis.

2. Designation

(1) Because this is not a hot chassis, it is not necessary to use an isolation transformer. However, the use of isolation transformer will help protect test instrument.
(2) Adjustment must be done in the correct order.
(3) The adjustment must be performed in the circumstance of 25 °C ± 5 °C of temperature and 65 % ± 10 % of relative humidity if there is no specific designation.
(4) The input voltage of the receiver must keep AC 100-240 V~, 50/60 Hz.
(5) The receiver must be operated for about 5 minutes prior to the adjustment when module is in the circumstance of over 15.

In case of keeping module is in the circumstance of 0 °C, it should be placed in the circumstance of above 15 °C for 2 hours.

In case of keeping module is in the circumstance of below -20 °C, it should be placed in the circumstance of above 15 °C for 3 hours.

[Caution]
When still image is displayed for a period of 20 minutes or longer (Especially where W/B scale is strong. Digital pattern 13ch and/or Cross hatch pattern 09ch), there can some afterimage in the black level area.

3. Automatic Adjustment

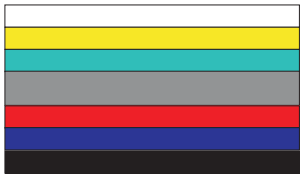
3.1. ADC Adjustment

3.1.1. Overview

ADC adjustment is needed to find the optimum black level and gain in Analog-to-Digital device and to compensate RGB deviation.

3.1.2. Equipment & Condition

(1) USB to RS-232C Jig
(2) MSPG-925 Series Pattern Generator(MSPG-925FA, pattern - 65)
- Resolution : 1080P Comp1
  1920*1080 RGB
- Pattern : Horizontal 100% Color Bar Pattern
- Pattern level : 0.7 ± 0.1 Vp-p
- Image



3.1.3. Adjustment

(1) Adjustment method
- Don't need to adjust ADC because there is data in OTP and adjusted initially.
- Check ADC adjustment
  1) Press In start key on the Adj. Remote Control, then Adjust ADC(OTP) status is displayed on "1.Adjustment check". Select "2.ADC Data", then ADC data is displayed.
  2) Press Adj. key on the Adjustmetn Remote Control, and select "9.ADC Calibration". Set up the ADC Type to OTP, then Select [Start] button by pressing Enter key, Component and RGB are Writed and display Success or NG.

(2) Adj. protocol

Protocol	Command	Set ACK
Enter adj. mode	aa 00 00	a 00 OK00x
Source change	xb 00 04	b 00 OK04x (Adjust 480i, 1080p Comp1)
	xb 00 06	b 00 OK06x (Adjust 1920*1080 RGB)
Begin adj.	ad 00 10	
Return adj. result		OKx (Case of Success) NGx (Case of Fail)
Read adj. data	(main) ad 00 20	(main) 00000000000000000000000000007c007b006dx
	(sub) ad 00 21	(Sub) 00000007000000000000000000007c00830077x
Confirm adj.	ad 00 99	NG 03 00x (Fail) NG 03 01x (Fail) NG 03 02x (Fail) OK 03 03x (Success)
End adj.	aa 00 90	a 00 OK90x

Ref.) ADC Adj. RS232C Protocol_Ver1.0

(3) Adj. order
- aa 00 00 [Enter ADC adj. mode]
- xb 00 04 [Change input source to Component1 (480i& 1080p)]
- ad 00 10 [Adjust 480i&1080p Comp1]
- xb 00 06 [Change input source to RGB(1024*768)]
- ad 00 10 [Adjust 1920*1080 RGB]
- ad 00 90 End adj.

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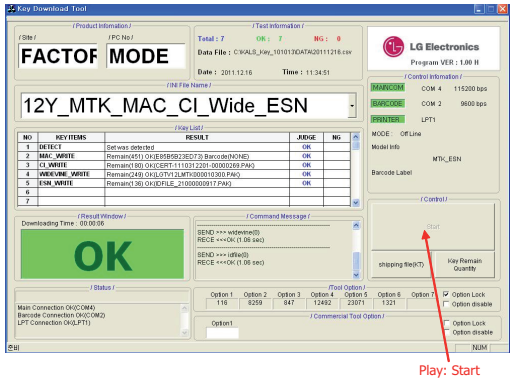
3.2. MAC address D/L, CI+ key D/L, Widevine key D/L, ESN D/L

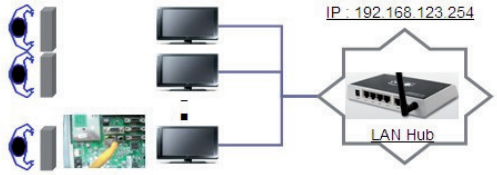
Connect: USB port
Communication Prot connection
▪ Com 1,2,3,4 and 115200(Baudrate)
Mode check: Online Only
▪ check the test process: DETECT -> MAC -> CI -> Widevine -> ESN
▪. Play: START
▪. Result: Ready, Test, OK or NG
▪. Printer Out (MAC Address Label)



3.3. LAN

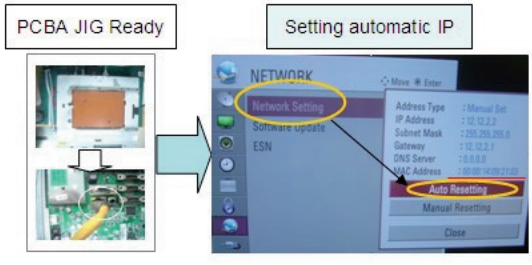
3.3.1. Equipment & Condition

▪ Each other connection to LAN Port of IP Hub and Jig



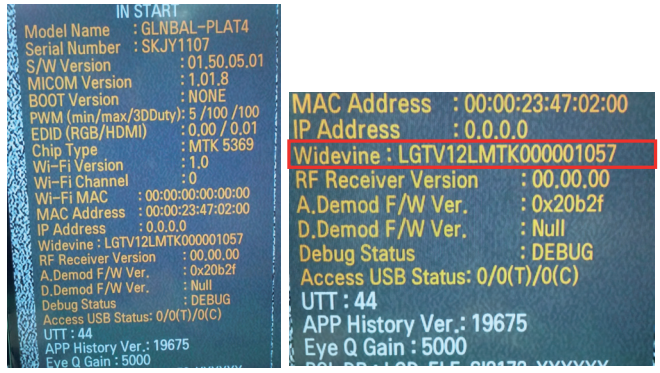
3.3.2. LAN inspection solution

▪ LAN Port connection with PCB
▪ Network setting at MENU Mode of TV
▪ Setting automatic IP
▪ Setting state confirmation
→ If automatic setting is finished, you confirm IP and MAC Address.



3.3.3. WIDEVINE key Inspection

- Confirm key input data at the "IN START" MENU Mode.



3.4. LAN PORT INSPECTION(PING TEST)

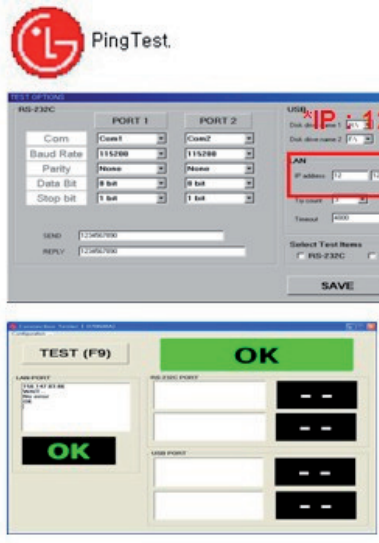
Connect SET → LAN port == PC → LAN Port

3.4.1. Equipment setting

(1) Play the LAN Port Test PROGRAM.
(2) Input IP set up for an inspection to Test Program.
*IP Number : 12.12.2.2

3.4.2. LAN PORT inspection(PING TEST)

(1) Play the LAN Port Test Program.
(2) Connect each other LAN Port Jack.
(3) Play Test (F9) button and confirm OK Message.
(4) Remove LAN cable.



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3.5. Model name & Serial number Download

3.5.1. Model name & Serial number D/L

- Press "Power on" key of service remote control. (Baud rate : 115200 bps)
- Connect RS232 Signal Cable to RS-232 Jack.
- Write Serial number by use RS-232.
- Must check the serial number at Instart menu.

3.5.2. Method & notice

(1) Serial number D/L is using of scan equipment.
(2) Setting of scan equipment operated by Manufacturing Technology Group.
(3) Serial number D/L must be conformed when it is produced in production line, because serial number D/L is mandatory by D-book 4.0

* Manual Download (Model Name and Serial Number)
If the TV set is downloaded by OTA or service man, sometimes model name or serial number is initialized.(Not always)
It is impossible to download by bar code scan, so It need Manual download.
1) Press the "Instart" key of Adjustment remote control.
2) Go to the menu "5.Model Number D/L" like below photo.
3) Input the Factory model name(ex 47LM760S-ZB-A) or Serial number like photo.

4) Check the model name Instart menu. → Factory name displayed. (ex 47LM760S-ZB)
5) Check the Diagnostics.(DTV country only) → Buyer model displayed. (ex 47LM760S-ZB)

3.6. CI+ Key checking method

- Check the Section 3.2

Check whether the key was downloaded or not at 'In Start' menu. (Refer to below).

=> Check the Download to CI+ Key value in LGset.

3.6.1. Check the method of CI+ Key value

(1) Check the method on Instart menu
(2) Check the method of RS232C Command
1) Into the main ass'y mode(RS232: aa 00 00)

CMD 1	CMD 2	Data 0	
A	A	0	0

2) Check the key download for transmitted command (RS232: ci 00 10)

CMD 1	CMD 2	Data 0	
C	I	1	0

3) Result value
- Normally status for download : OKx
- Abnormally status for download : NGx

3.6.2. Check the method of CI+ key value(RS232)

1) Into the main ass'y mode(RS232: aa 00 00)

CMD 1	CMD 2	Data 0	
A	A	0	0

2) Check the mothed of CI+ key by command (RS232: ci 00 20)

CMD 1	CMD 2	Data 0	
C	I	2	0

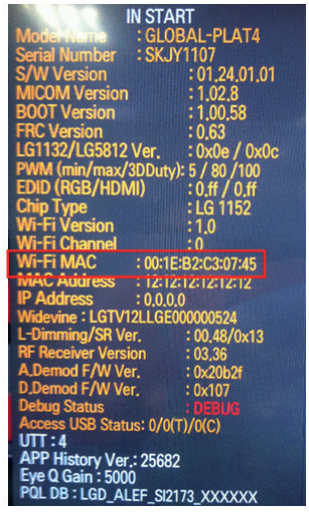
3) Result value
i 01 OK 1d1852d21c1ed5dcx
→ CI+ Key Value

3.7. WIFI MAC ADDRESS CHECK

(1) Using RS232

	H-freq(kHz)	V-freq.(Hz)
Transmission	[A][I][][Set ID][][20][Cr]	[O][K][X] or [NG]

(2) Check the menu on in-start.



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4. Manual Adjustment

* ADC adjustment is not needed because of OTP(Auto ADC adjustment)

4.1 EDID(The Extended Display Identification Data)/DDC(Display Data Channel) download

4.1.1. Overview

It is a VESA regulation. A PC or a MNT will display an optimal resolution through information sharing without any necessity of user input. It is a realization of "Plug and Play".

4.1.2. Equipment

- Since embedded EDID data is used, EDID download JIG, HDMI cable and D-sub cable are not need.
- Adjustment remote control

4.1.3. Download method

(1) Press "ADJ" key on the Adjustment remote control then select "10.EDID D/L", By pressing "Enter" key, enter EDID D/L menu.

(2) Select "Start" button by pressing "Enter" key, HDMI1/ HDMI2/ HDMI3/ HDMI4/ RGB are writing and display OK or NG.

For Analog	For HDMI EDID
D-sub to D-sub	DVI-D to HDMI or HDMI to HDMI

4.1.4. EDID DATA

(1) 3D EDID DATA

HDMI_EDID DATA _3D

	0x00	0x01	0x02	0x03	0x04	0x05	0x06	0x07	0x08	0x09	0x0A	0x0B	0x0C	0x0D	0x0E	0x0F
0x00	00	FF	FF	FF	FF	FF	FF	00	1E	6D	ⓐ		ⓑ			
0x01	ⓒ		01	03	80	A0	5A	78	0A	EE	91	A3	54	4C	99	26
0x02	0F	50	54	A1	08	00	31	40	45	40	61	40	71	40	81	80
0x03	01	01	01	01	01	01	02	3A	80	18	71	38	2D	40	58	2C
0x04	45	00	A0	5A	00	00	00	1E	66	21	50	B0	51	00	1B	30
0x05	40	70	36	00	A0	5A	00	00	00	1E	00	00	00	FD	00	3A
0x06	3E	1E	53	10	00	0A	20	20	20	20	20	20	ⓓ			
0x07	ⓓ														01	ⓔ1
0x00	02	03	37	F1	4E	10	9F	04	13	05	14	03	02	12	20	21
0x01	22	15	01	26	15	07	50	09	57	07	ⓕ					
0x02	ⓕ							ⓕ								
0x03	ⓕ			ⓖ				02	3A	80	18	71	38	2D	40	58
0x04	2C	45	00	A0	5A	00	00	00	1E	01	1D	80	18	71	1C	16
0x05	20	58	2C	25	00	A0	5A	00	00	00	9E	01	1D	00	72	51
0x06	D0	1E	20	6E	28	55	00	A0	5A	00	00	00	1E	00	00	00
0x07	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	ⓔ2

RGB_EDID DATA

	0x00	0x01	0x02	0x03	0x04	0x05	0x06	0x07	0x08	0x09	0x0A	0x0B	0x0C	0x0D	0x0E	0x0F
0x00	00	FF	FF	FF	FF	FF	FF	00	1E	6D	ⓐ		ⓑ			
0x01	ⓒ		01	03	68	A0	5A	78	0A	EE	91	A3	54	4C	99	26
0x02	0F	50	54	A1	08	00	31	40	45	40	61	40	71	40	81	80
0x03	01	01	01	01	01	01	02	3A	80	18	71	38	2D	40	58	2C
0x04	45	00	A0	5A	00	00	00	1E	66	21	50	B0	51	00	1B	30
0x05	40	70	36	00	A0	5A	00	00	00	1E	00	00	00	FD	00	3A
0x06	3E	1E	53	10	00	0A	20	20	20	20	20	20	ⓓ			
0x07	ⓓ														00	ⓔ3

▪ Reference

- HDMI1 ~ HDMI4 / RGB
- In the data of EDID, bellows may be different by S/W or Input mode.

ⓐ. Product ID

HEX	EDID Table	DDC Function
0001	01 00	Analog/Digital

ⓑ. Serial No: Controlled on production line.

ⓒ. Month, Year: Controlled on production line:

ex) Week : '01' -> '01'

Year : '2012' -> '16' fix

ⓓ. Model Name(Hex): LGTV

Chassis	MODEL NAME(HEX)
LD22E	00 00 00 FC 00 4C 47 20 54 56 0A 20 20 20 20 20 20 20

ⓔ. Checksum: Changeable by total EDID data.

	ⓔ1	ⓔ2 10 bit/ Xvycc	ⓔ2 8 bit/ Xvycc	ⓔ2 10 bit/ none XvYcc	ⓔ2 8 bit/ none XvYcc	ⓔ3
HDMI1	43	11	49	15	4D	X
HDMI2	43	01	39	05	3D	X
HDMI3	43	F1	29	F5	2D	X
HDMI4	43	E1	19	E5	1D	X
RGB	X	X	X	X	X	5C

ⓕ. Vendor Specific(HDMI)

1) Deep color (module 10bit)

INPUT	MODEL NAME(HEX)
HDMI1	78 03 0C 00 10 00 B8 2D 20 C0 0E 01 4F 3F FC 08 10 18 10 06 10 16 10 28 10
HDMI2	78 03 0C 00 20 00 B8 2D 20 C0 0E 01 4F 3F FC 08 10 18 10 06 10 16 10 28 10
HDMI3	78 03 0C 00 30 00 B8 2D 20 C0 0E 01 4F 3F FC 08 10 18 10 06 10 16 10 28 10
HDMI4	78 03 0C 00 40 00 B8 2D 20 C0 0E 01 4F 3F FC 08 10 18 10 06 10 16 10 28 10

2) None deep color (module 8bit)

INPUT	MODEL NAME(HEX)
HDMI1	78 03 0C 00 10 00 80 2D 20 C0 0E 01 4F 3F FC 08 10 18 10 06 10 16 10 28 10
HDMI2	78 03 0C 00 20 00 80 2D 20 C0 0E 01 4F 3F FC 08 10 18 10 06 10 16 10 28 10
HDMI3	78 03 0C 00 30 00 80 2D 20 C0 0E 01 4F 3F FC 08 10 18 10 06 10 16 10 28 10
HDMI4	78 03 0C 00 40 00 80 2D 20 C0 0E 01 4F 3F FC 08 10 18 10 06 10 16 10 28 10

ⓖ Colorimetry Data Block(HDMI)

- The Model not supporting XvYcc(Except for LM7600)

INPUT	MODEL NAME(HEX)
HDMI1	E3 05 00 00
HDMI2	E3 05 00 00
HDMI3	E3 05 00 00
HDMI4	E3 05 00 00

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4.2. White Balance Adjustment

4.2.1. Overview

▪ W/B adj. Objective & How-it-works

(1) Objective: To reduce each Panel's W/B deviation

(2) How-it-works : When R/G/B gain in the OSD is at 192, it means the panel is at its Full Dynamic Range. In order to prevent saturation of Full Dynamic range and data, one of R/G/B is fixed at 192, and the other two is lowered to find the desired value.

(3) Adjustment condition : normal temperature

1) Surrounding Temperature : 25 °C ± 5 °C

2) Warm-up time: About 5 Min

3) Surrounding Humidity : 20 % ~ 80 %

4.2.2. Equipment

(1) Color Analyzer: CA-210 (LED Module : CH 14)

(2) Adjustment Computer(During auto adj., RS-232C protocol is needed)

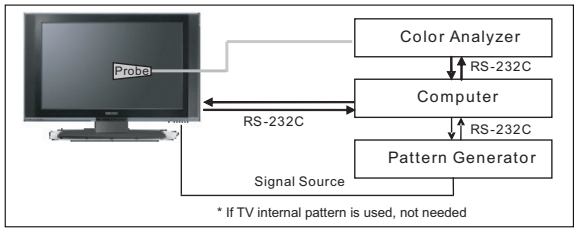
(3) Adjustment Remote control

(4) Video Signal Generator MSPG-925F 720p/204-Gray (Model: 217, Pattern: 49)

-> Only when internal pattern is not available

▪ Color Analyzer Matrix should be calibrated using CS-100.

4.2.3. Equipment connection MAP



4.2.4. Adj. Command (Protocol)

<Command Format>

START	6E	A	50	A	LEN	A	03	A	CMD	A	00	A	VAL	A	CS	STOP

- LEN: Number of Data Byte to be sent
- CMD: Command
- VAL: FOS Data value
- CS: Checksum of sent data
- A: Acknowledge

Ex) [Send: JA_00_DD] / [Ack: A_00_okDDX]

▪ RS-232C Command used during auto-adjustment.

RS-232C COMMAND [CMD	ID	DATA]	Explantion
wb	00	00	Begin White Balance adjustment
wb	00	10	Gain adjustment(internal white pattern)
wb	00	1f	Gain adjustment completed
wb	00	20	Offset adjustment(internal white pattern)
wb	00	2f	Offset adjustment completed
wb	00	ff	End White Balance adjustment (internal pattern disappears)

Ex) wb 00 00 -> Begin white balance auto-adj.
wb 00 10 -> Gain adj.
ja 00 ff -> Adj. data
jb 00 c0
...
...
wb 00 1f → Gain adj. completed
*(wb 00 20(Start), wb 00 2f(end)) → Off-set adj.
wb 00 ff → End white balance auto-adj.

▪ Adj. Map

	Adj. item	Command (lower caseASCII)		Data Range (Hex.)		Default (Decimal)
		CMD1	CMD2	MIN	MAX	
Cool	R Gain	j	g	00	C0	
	G Gain	j	h	00	C0	
	B Gain	j	i	00	C0	
	R Cut					
	G Cut					
	B Cut					
Medium	R Gain	j	a	00	C0	
	G Gain	j	b	00	C0	
	B Gain	j	c	00	C0	
	R Cut					
	G Cut					
	B Cut					
Warm	R Gain	j	d	00	C0	
	G Gain	j	e	00	C0	
	B Gain	j	f	00	C0	
	R Cut					
	G Cut					

4.2.5. Adj. method

(1) Auto adj. method

1) Set TV in adj. mode using P-Only key.

2) Zero calibrate probe then place it on the center of the Display.

3) Connect Cable.(RS-232C to USB)

4) Select mode in adj. Program and begin adj.

5) When adj. is complete (OK Sign), check adj. status pre mode. (Warm, Medium, Cool)

6) Remove probe and RS-232C cable to complete adj.

▪ W/B Adj. must begin as start command “wb 00 00” , and finish as end command “wb 00 ff”, and Adj. offset if need.

(2) Manual adjustment. method

1) Set TV in Adj. mode using P-Only key.

2) Zero Calibrate the probe of Color Analyzer, then place it on the center of LCD module within 10 cm of the surface.

3) Press ADJ key → EZ adjust using adj. R/C → 7. White-Balance then press the cursor to the right(key ►). (When right key(►) is pressed 216 Gray internal pattern will be displayed)

4) One of R Gain / G Gain / B Gain should be fixed at 192, and the rest will be lowered to meet the desired value.

5) Adjustment is performed in COOL, MEDIUM, WARM 3 modes of color temperature.

▪ If internal pattern is not available, use RF input. In EZ Adj. menu 7.White Balance, you can select one of 2 Test-pattern: ON, OFF. Default is inner(ON). By selecting OFF, you can adjust using RF signal in 216 Gray pattern.

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▪ Adjustment condition and cautionary items

1) Lighting condition in surrounding area
Surrounding lighting should be lower 10 lux. Try to isolate adj. area into dark surrounding.

2) Probe location
: Color Analyzer(CA-210) probe should be within 10 cm and perpendicular of the module surface.(80° ~ 100°)

3) Aging time
- After Aging Start, Keep the Power ON status during 5 Minutes.
- In case of LCD, Back-light on should be checked using no signal or Full-white pattern.

4.2.6. Reference(White balance adjusmtment coordinate and color temperature)

▪ Luminance : 204 Gray

▪ Standard color coordinate and temperature using CS-1000 (over 26 inch)

Mode	Coordinate		Temp	Δuv
	x	y		
Cool	0.269	0.273	13000 K	0.0000
Medium	0.285	0.293	9300 K	0.0000
Warm	0.313	0.329	6500 K	0.0000

▪ Standard color coordinate and temperature using CA-210(CH 14)

Mode	Coordinate		Temp	Δuv
	x	y		
Cool	0.269 ± 0.002	0.273 ± 0.002	13000 K	0.0000
Medium	0.285 ± 0.002	0.293 ± 0.002	9300 K	0.0000
Warm	0.313 ± 0.002	0.329 ± 0.002	6500 K	0.0000

4.2.7. LED White balance table

- EDGE LED module change color coordinate because of aging time.
- Apply under the color coordinate table, for compensated aging time.
- ALEF

GP4	Aging time (Min)	Cool		Medium		Warm	
		X	y	x	y	x	y
		269	273	285	293	313	329
1	0-2	283	293	299	313	320	339
2	3-5	282	291	298	311	319	337
3	6-9	281	290	297	310	318	336
4	10-19	279	289	295	309	316	335
5	20-35	277	284	293	304	314	330
6	36-49	274	279	290	299	311	325
7	50-79	271	277	287	297	308	323
8	80-119	270	274	286	294	307	320
9	Over 120	269	273	285	293	306	319

4.3. EYE-Q function check

(1) Turn on TV.
(2) Press EYE key of Adjustment remote control.
(3) Cover the Eye Q II sensor on the front of the using your hand and wait for 6 seconds.
(4) Confirm that R/G/B value is lower than 10 of the "Raw Data (Sensor data, Back light)". If after 6 seconds, R/G/B value is not lower than 10, replace Eye Q II sensor.
(5) Remove your hand from the Eye Q II sensor and wait for 6 seconds.
(6) Confirm that "ok" pop up. If change is not seen, replace Eye Q II sensor.

4.4. Local Dimming Function Check

Step 1) Turn on TV.
Step 2) Press “TILT” key on the Adj. R/C.
Step 3) At the Local Dimming mode, module Edge Backlight moving right to left Back light of IOP module moving.
Step 4) Confirm the Local Dimming mode.
Step 5) Press "exit" key.

Local Dimming Demo
(Edge LED Model)

4.5. Magic Motion Remote control test

(1) Equipment : RF Remote control for test, IR-KEY-Code Remote control for test
(2) You must confirm the battery power of RF-Remote control before test(recommend that change the battery per every lot)
(3) Sequence (test)
1) if you select the "Start(Wheel)" key on the Adjustment remote control, you can pairing with the TV SET.
2) You can check the cursor on the TV Screen, when select the "Wheel" key on the Adjustment remote control.
3) You must remove the pairing with the TV Set by select "Mute" key on the Adjustment remote control

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4.6. 3D function test

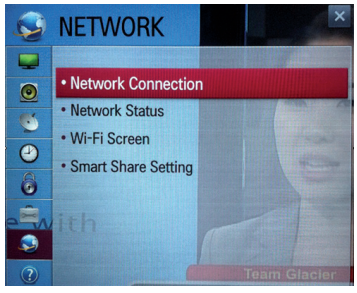
(Pattern Generator MSHG-600, MSPG-6100[Support HDMI1.4])
* HDMI mode NO. 872 , pattern No.83
(1) Please input 3D test pattern like below.

(2) When 3D OSD appear automatically, then select OK key.

(3) Don't wear a 3D Glasses, check the picture like below.

4.7. Wi-Fi Test

Step 1) Turn on TV
Step 2) Select Network Connection option in Network Menu.



Step 3) Select Start Connection button in Network Connection.

Step 4) If the system finds any AP like blow PIC, it is working well.

4.8. LNB voltage and 22KHz tone check

(only for DVB-S/S2 model)

▪ Test method
(1) Set TV in Adj. mode using POWER ON.
(2) Connect cable between satellite ANT and test JIG.
(3) Press Yellow key(ETC+SWAP) in Adj Remote control to make LNB on.
(4) Check LED light 'ON' at 18 V menu.
(5) Check LED light 'ON' at 22 KHz tone menu.
(6) Press Blue key(ETC+PIP INPUT) in Adj Remote control to make LNB off.
(7) Check LED light 'OFF' at 18 V menu.
(8) Check LED light 'OFF' at 22 KHz tone menu.

▪ Test result
(1) After press LNB On key, '18 V LED' and '22 KHz tone LED' should be ON.
(2) After press LNB OFF key, '18 V LED' and '22 KHz tone LED' should be OFF.

4.9. Option selection per country

4.9.1. Overview

- Option selection is only done for models in Non-EU

4.9.2. Method

(1) Press ADJ key on the Adj. R/C, then select Country Group Meun
(2) Depending on destination, select Country Group Code 04 or Country Group EU then on the lower Country option, select US, CA, MX. Selection is done using +, - or ►◄ key.

4.10. Tool Option selection

▪ Method : Press "ADJ" key on the Adjustment remote control, then select Tool option.

4.11. Ship-out mode check(In-stop)

▪ After final inspection, press "IN-STOP" key of the Adjustment remote control and check that the unit goes to Stand-by mode.

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4.12. GND and Internal Pressure check

4.12.1. Method

(1) GND & Internal Pressure auto-check preparation
- Check that Power cord is fully inserted to the SET. (If loose, re-insert)

(2) Perform GND & Internal Pressure auto-check
- Unit fully inserted Power cord, Antenna cable and A/V arrive to the auto-check process.
- Connect D-terminal to AV JACK TESTER
- Auto CONTROLLER(GWS103-4) ON
- Perform GND TEST
- If NG, Buzzer will sound to inform the operator.
- If OK, changeover to I/P check automatically. (Remove CORD, A/V form AV JACK BOX.)
- Perform I/P test
- If NG, Buzzer will sound to inform the operator.
- If OK, Good lamp will lit up and the stopper will allow the pallet to move on to next process.

4.12.2. Checkpoint

▪ TEST voltage
- GND: 1.5 KV / min at 100 mA
- SIGNAL: 3 KV / min at 100 mA

▪ TEST time: 1 second

▪ TEST POINT
- GND TEST = POWER CORD GND & SIGNAL CABLE METAL GND
- Internal Pressure TEST = POWER CORD GND & LIVE & NEUTRAL

▪ LEAKAGE CURRENT: At 0.5 mArms

5. Audio

No.	Item	Min	Typ	Max	Unit	Remark
1.	Audio practical max Output, L/R (Distortion=10% max Output)	9	10	12	W	EQ Off AVL Off Clear Voice Off
			8.10	10.8	Vrms	
2.	Speaker (8Ω Impedance)	9	10	12	W	EQ Off AVL Off Clear Voice Off

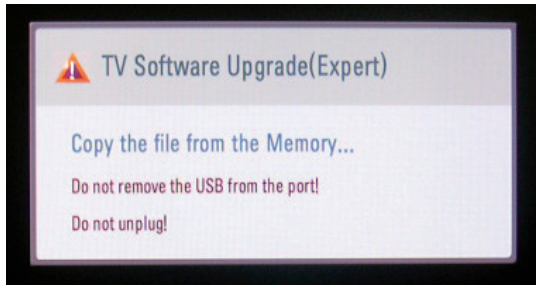
Measurement condition:
(1) RF input: Mono, 1 KHz sine wave signal, 100 % Modulation
(2) CVBS, Component: 1 KHz sine wave signal 0.5 Vrms
(3) RGB PC: 1 KHz sine wave signal 0.7 Vrms

6. USB S/W Download(Service only)

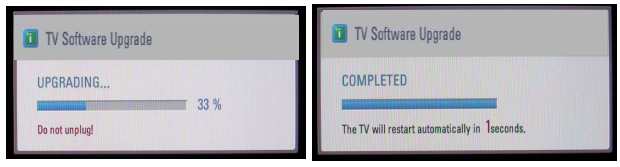
(1) Put the USB Stick to the USB socket.
(2) Automatically detecting update file in USB Stick.
- If your downloaded program version in USB Stick is Low, it didn't work. But your downloaded version is High, USB data is automatically detecting.

(Download Version High & Power only mode, Set is automatically Download)

(3) Show the message "Copying files from memory".



(4) Updating is starting.



(5) Updating Completed, The TV will restart automatically.
(6) If your TV is turned on, check your updated version and Tool option. (explain the Tool option, next stage)

* If downloading version is more high than your TV have, TV can lost all channel data. In this case, you have to channel recover. if all channel data is cleared, you didn't have a DTV/ ATV test on production line.

* After downloading, have to adjust Tool Option again.
(1) Push "IN-START" key in service remote control.
(2) Select "Tool Option 1" and push "OK" key.
(3) Punch in the number. (Each model has their number)

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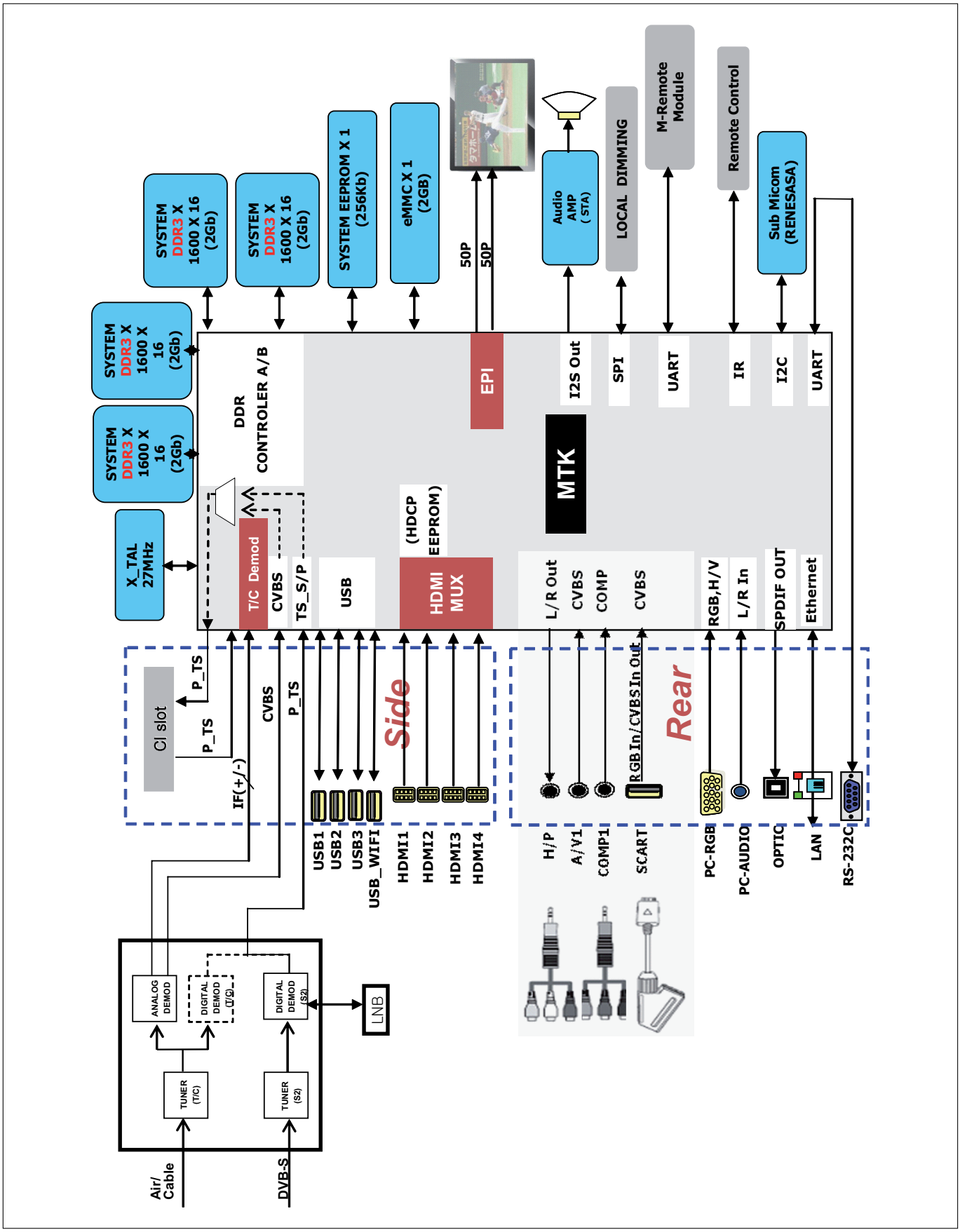
BLOCK DIAGRAM



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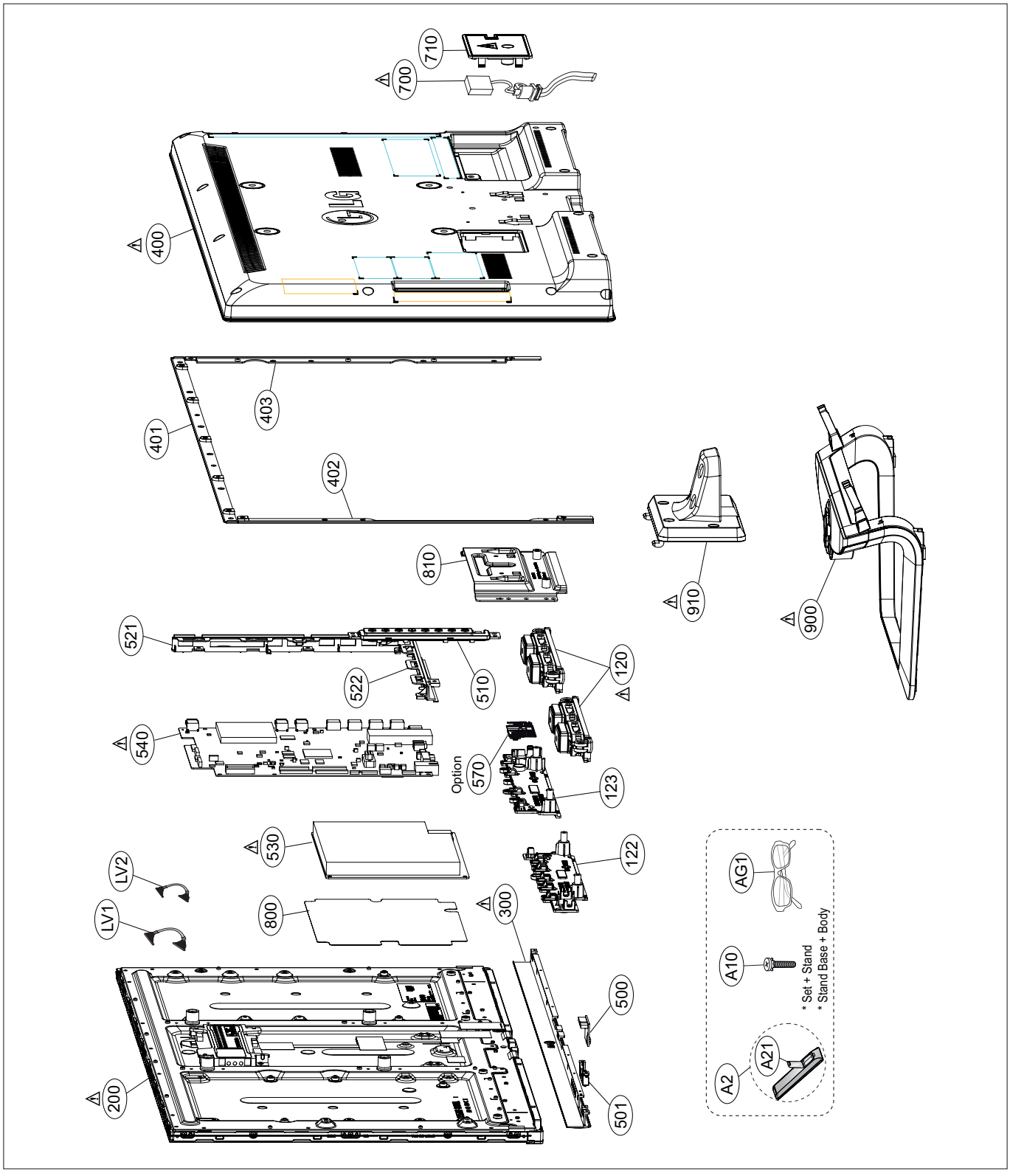
EXPLODED VIEW

IMPORTANT SAFETY NOTICE

Many electrical and mechanical parts in this chassis have special safety-related characteristics. These parts are identified by ⚠ in the Schematic Diagram and EXPLODED VIEW.
It is essential that these special safety parts should be replaced with the same components as recommended in this manual to prevent X-RADIATION, Shock, Fire, or other Hazards.
Do not modify the original design without permission of manufacturer.



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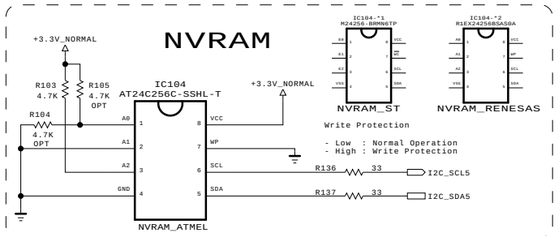
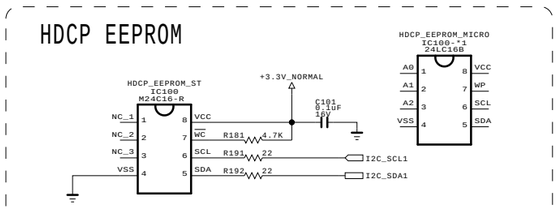
EAX6430790* : LD22* / LC22*
EAX6443420* : LT22* / LJ22* / LA22* / LB22*

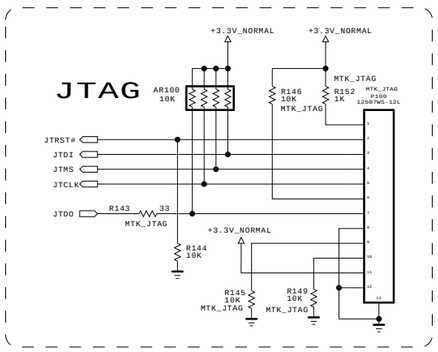
NVRAM



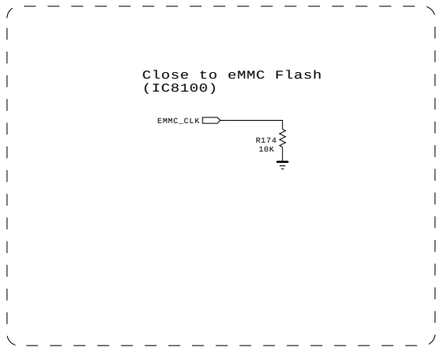
HDCP EEPROM



JTAG

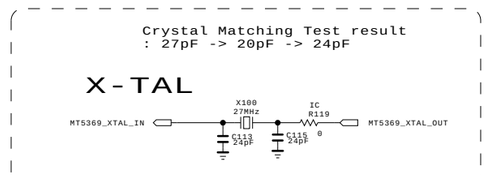


Close to eMMC Flash (IC8100)

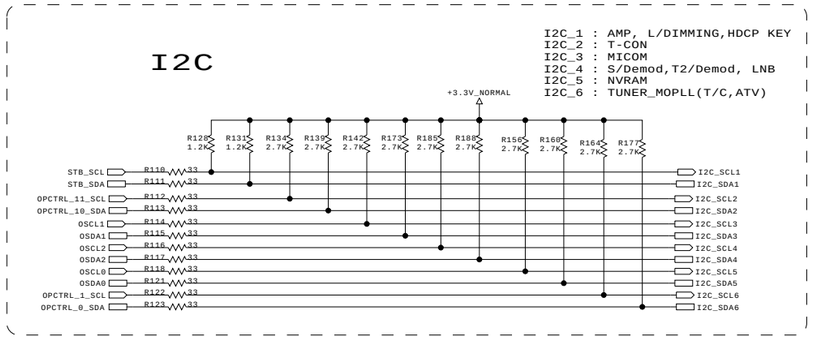


Crystal Matching Test result : 27pF -> 20pF -> 24pF

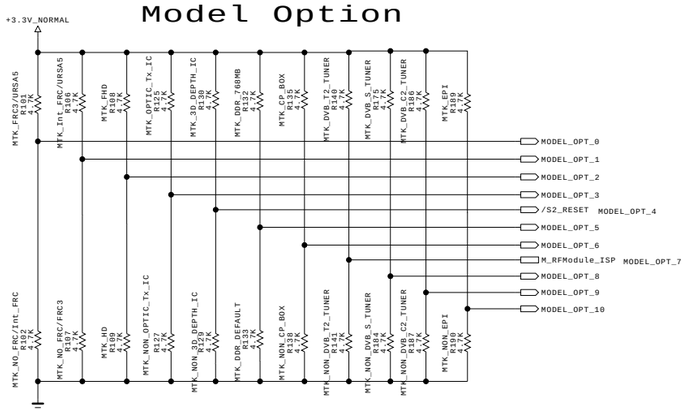
X-TAL



I2C



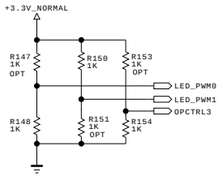
Model Option



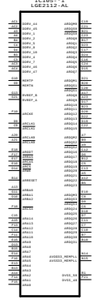
	NO_FRC	SoC internal FRC	LG FRC2	Reserved
MODEL_OPT_0	0	0	1	1
MODEL_OPT_1	0	1	0	1

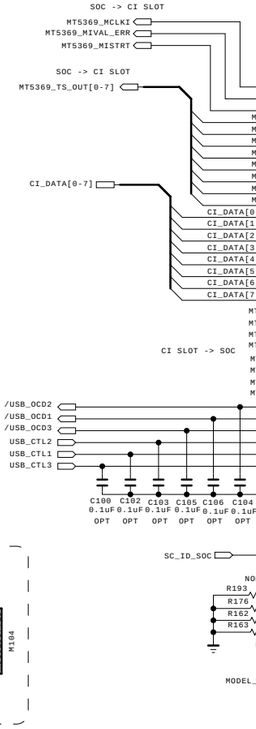
		HIGH	LOW
MODEL_OPT_2		FHD	HD
MODEL_OPT_3		OPTIC	NON_OPTIC
MODEL_OPT_4	3D DEPTH	3D_Depth_IC	NON_3D_Depth_IC
MODEL_OPT_5	DDR	DDR_768MB	DDR_Default
MODEL_OPT_6	CP BOX	Enable	Disable
MODEL_OPT_7	T2 Tuner	Support	Not Support
MODEL_OPT_8	S Tuner	Support	Not Support
MODEL_OPT_9	Reserved		Default
MODEL_OPT_10	EPI	Support	Not Support

MODEL OPTION 8 is just for CP Box
It should not be appiled at MP

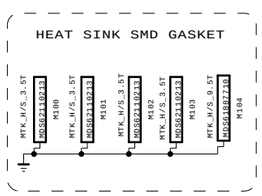


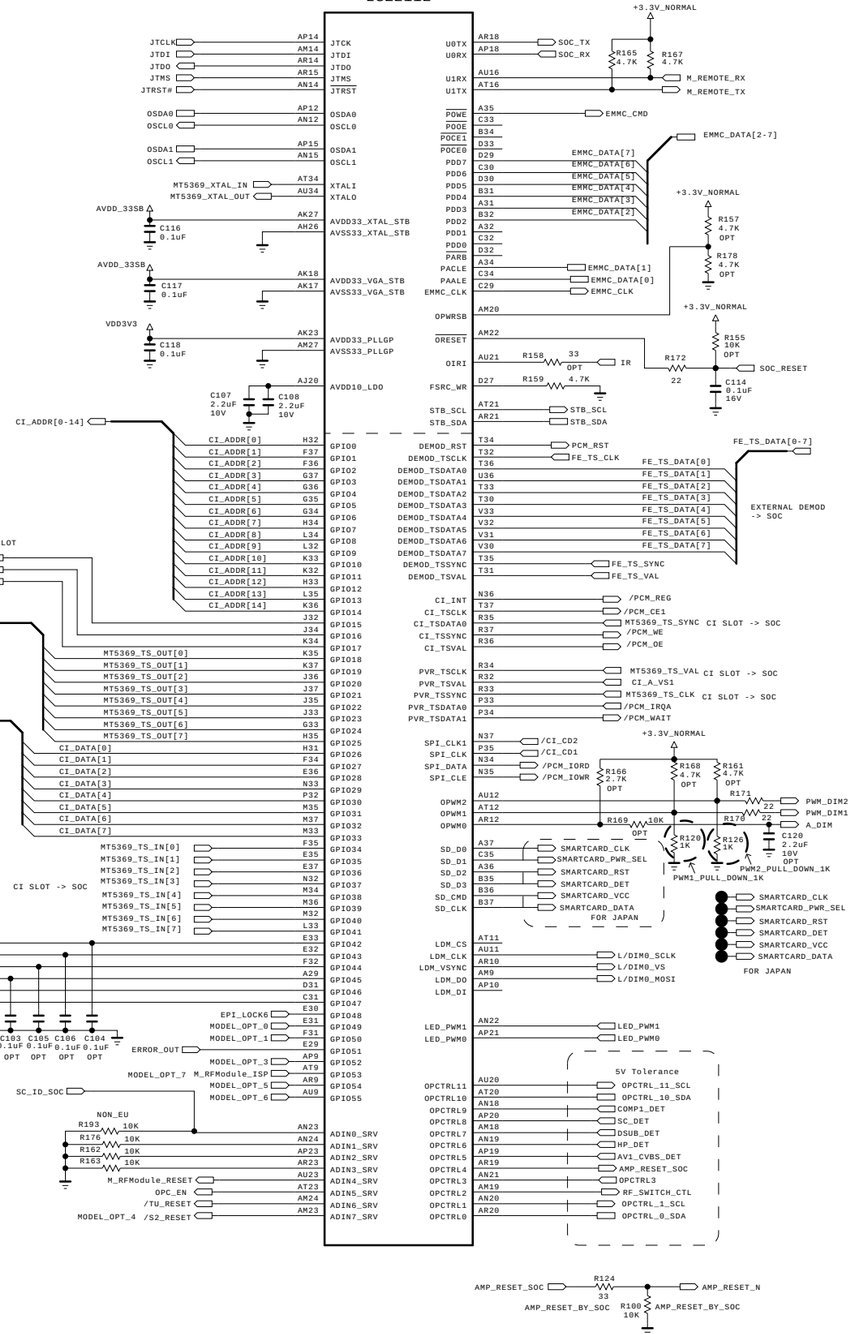
STRAPPING	LED_PWM0	LED_PWM1	OPCTRL3
ICE mode + 27M + Serial boot	0	0	0
ICE mode + 27M + ROM to Nand boot	0	0	1
ICE mode + 27M + Rom to eMMC boot from eMMC pins (share pins w/s NAND)	0	1	0
ICE mode + 27M + ROM to eMMC boot from SDIO pins	0	1	1





HEAT SINK SMD GASKET





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MODEL	MID_MAIN_1	DATE	2011.12.13
BLOCK		SHEET	8

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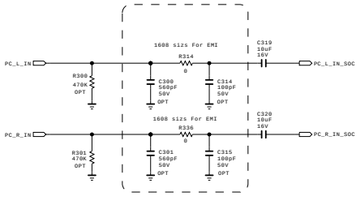
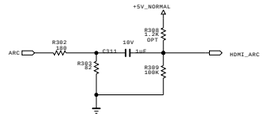
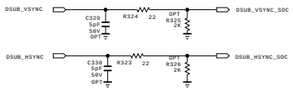
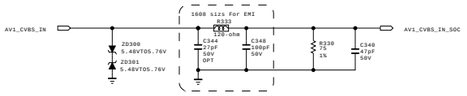
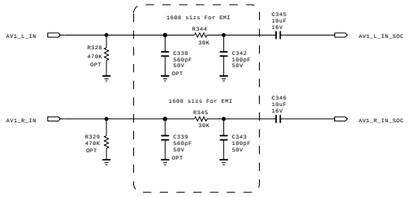
PLACE AT JACK SIDE

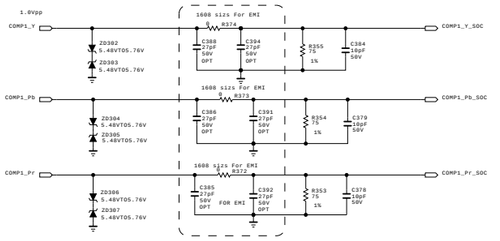


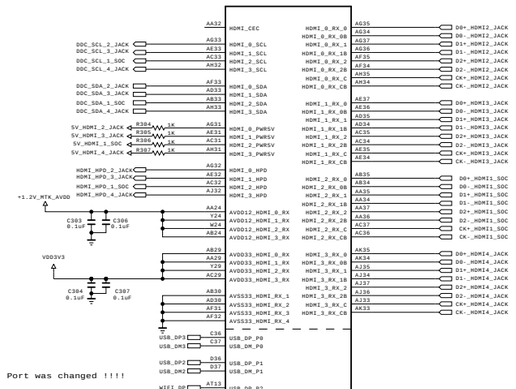


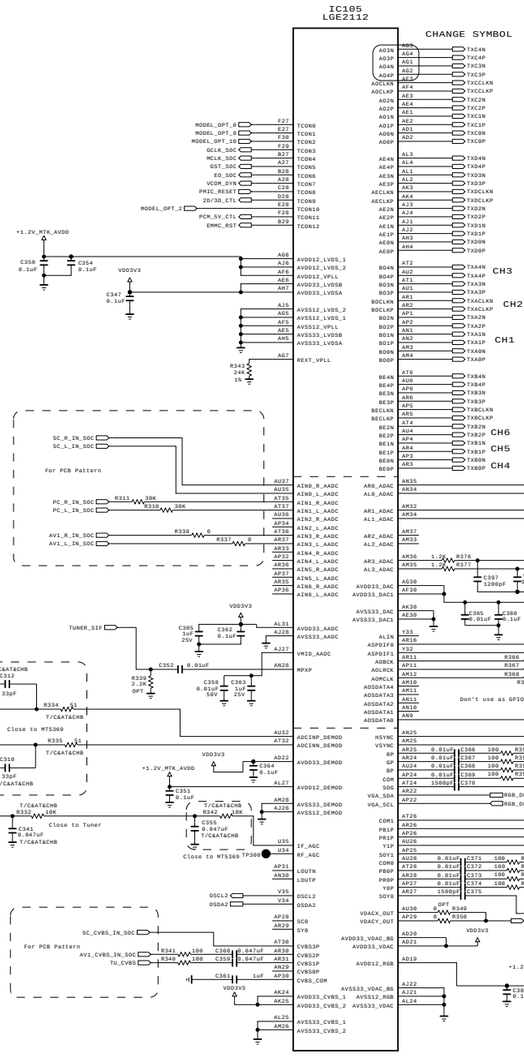


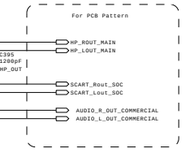


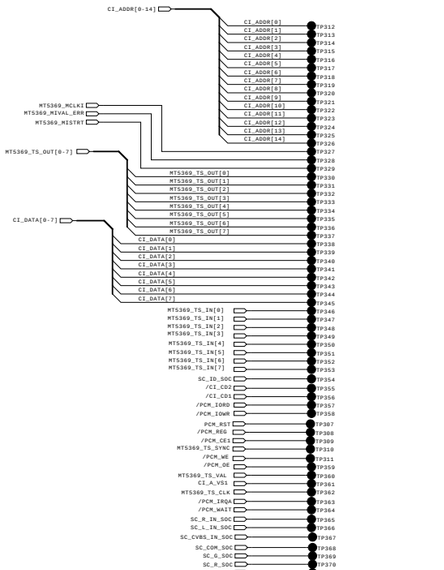


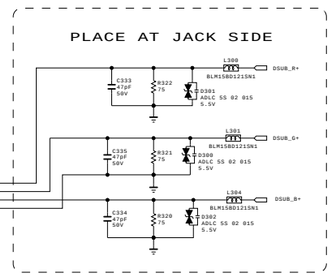


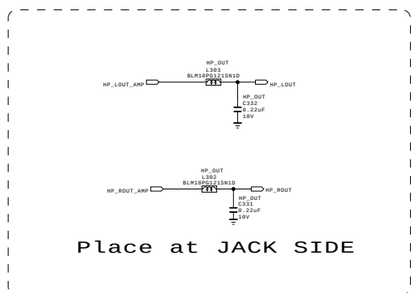












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MODEL	MID_MAIN_2	DATE	2011.12.19
BLOCK		SHEET	9

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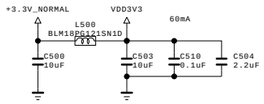
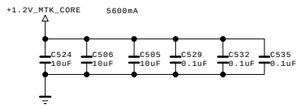
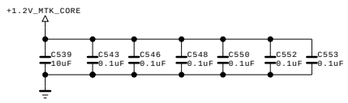
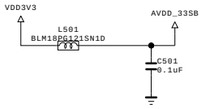
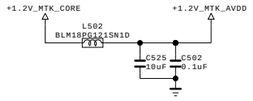
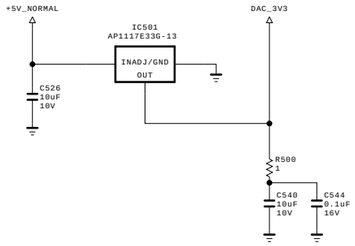


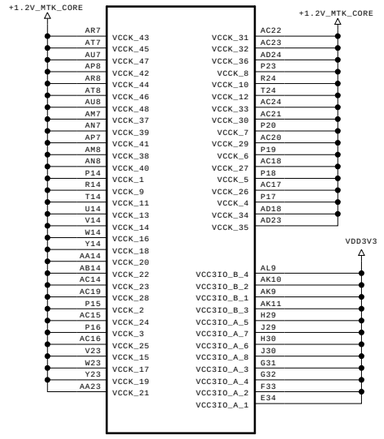


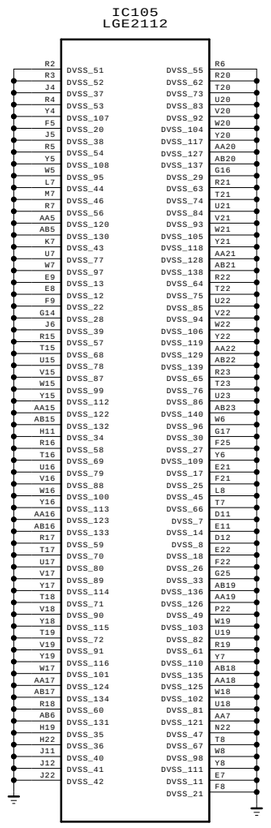


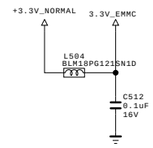


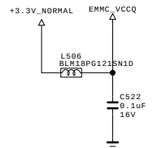


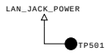




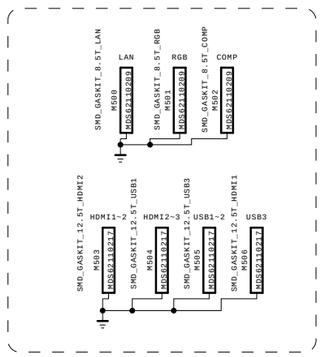


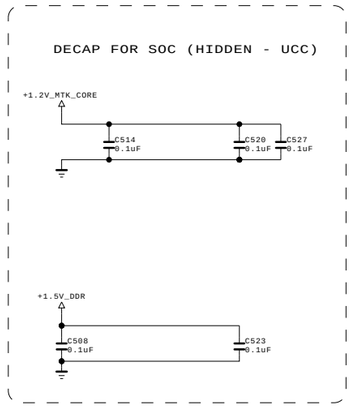


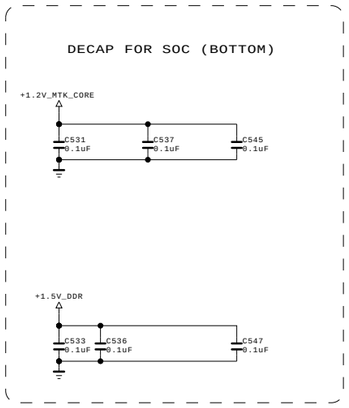




SMD Gaskit







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MODEL	MID_MAIN_3	DATE	2011.12.09
BLOCK		SHEET	10

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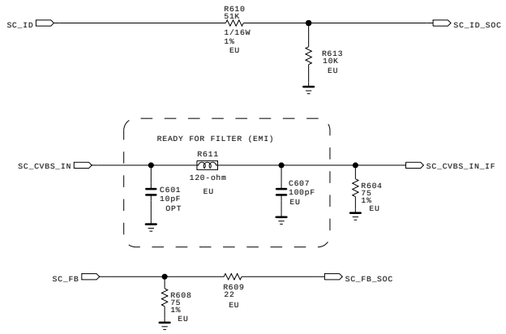
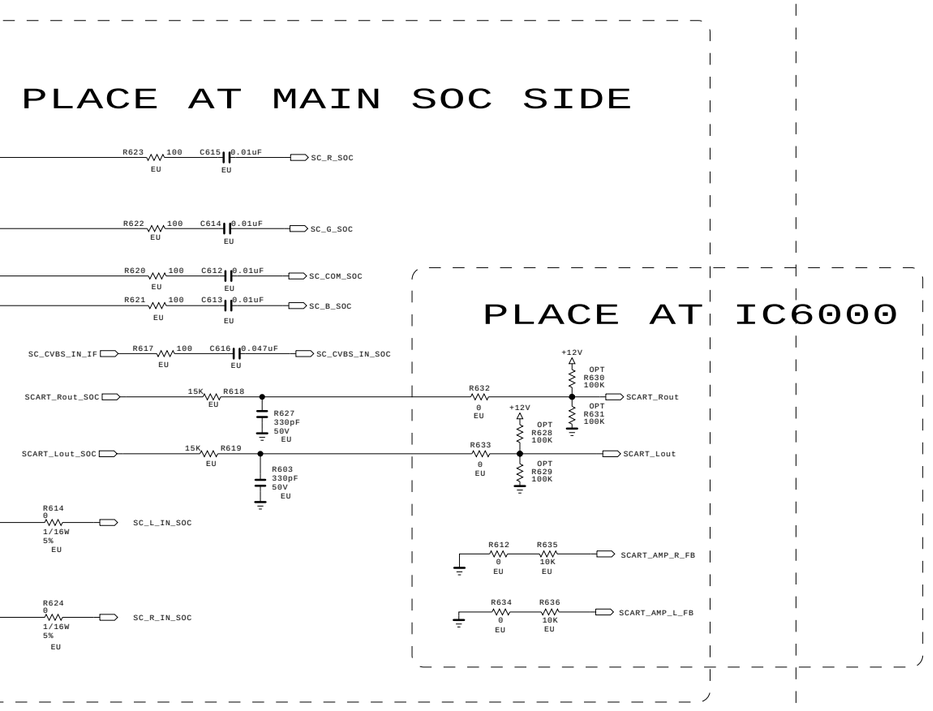
PLACE AT JACK SIDE



PLACE AT MAIN SOC SIDE



PLACE AT IC6000

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MODEL	MID_MAIN_SCART	DATE	2011.12.30
BLOCK		SHEET	11

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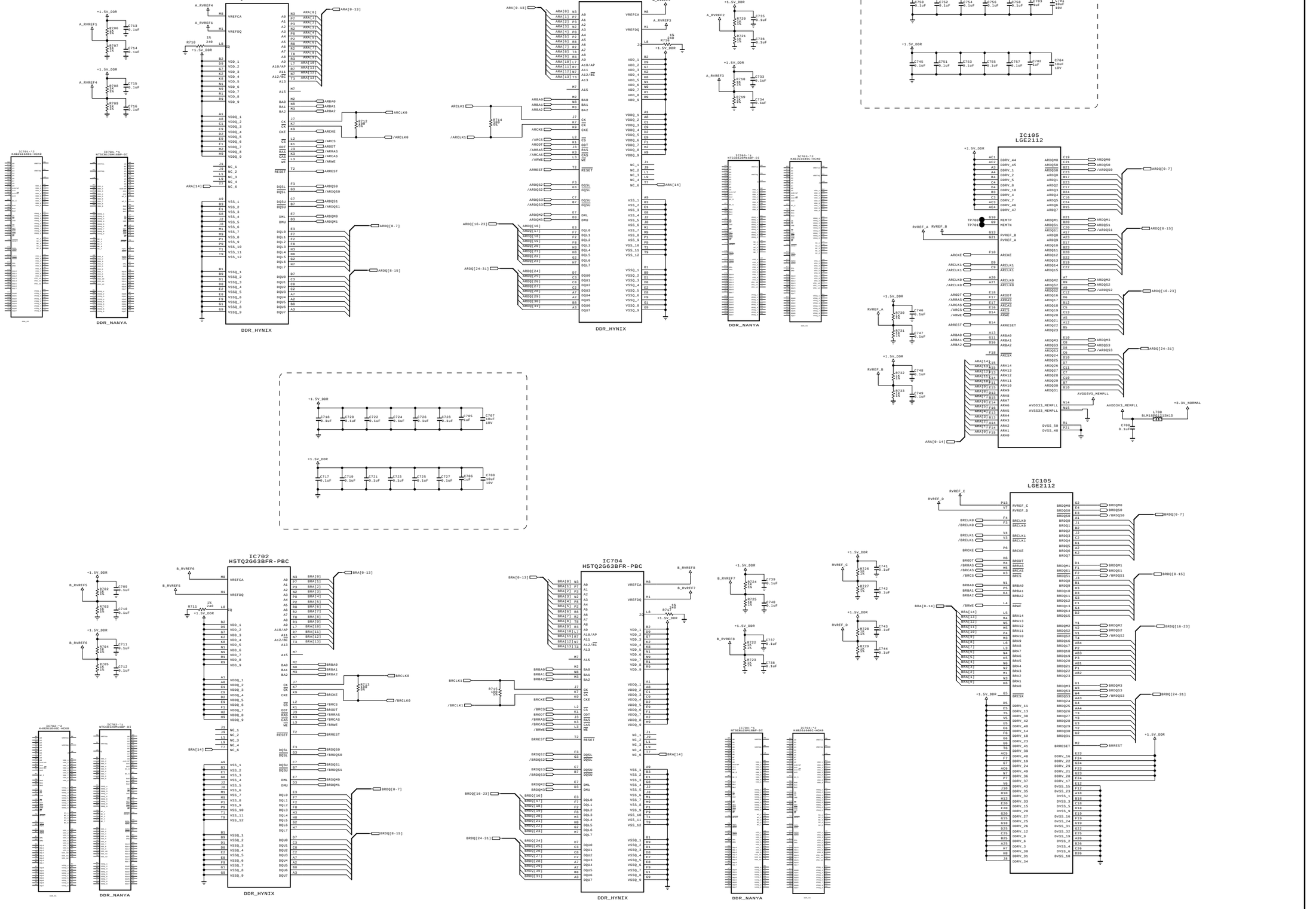

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MODEL		DATE	2011.12.09
BLOCK	DDR ONE SIDE	SHEET	12

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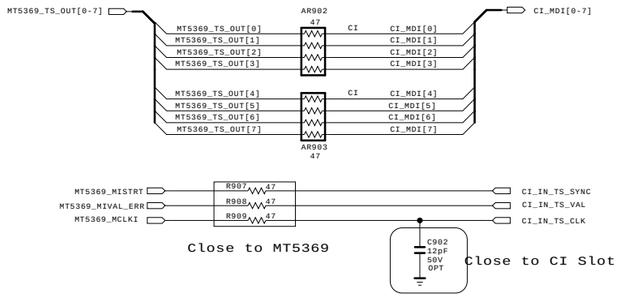
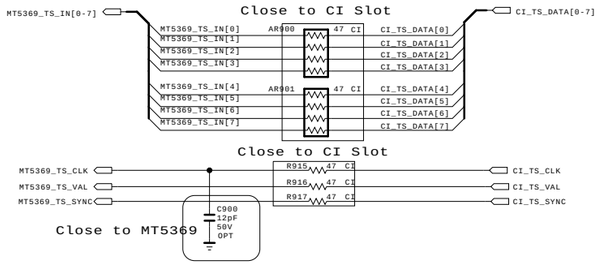
CI TS INPUT



CI TS OUTPUT



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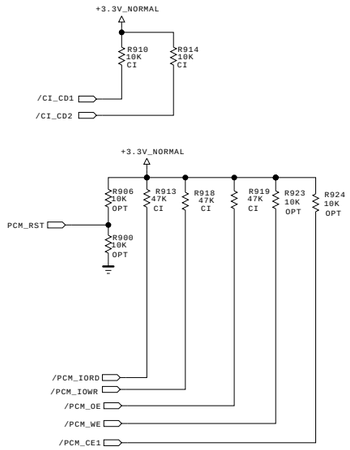

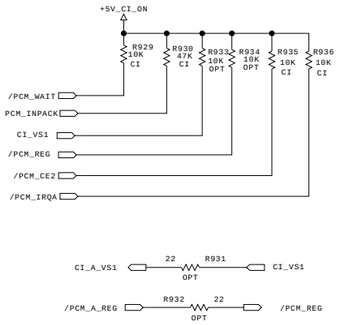

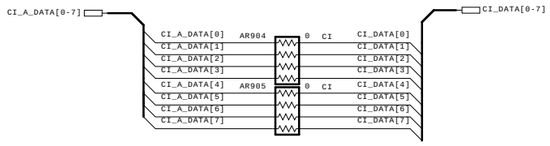

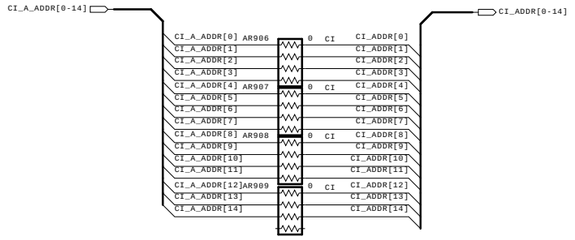

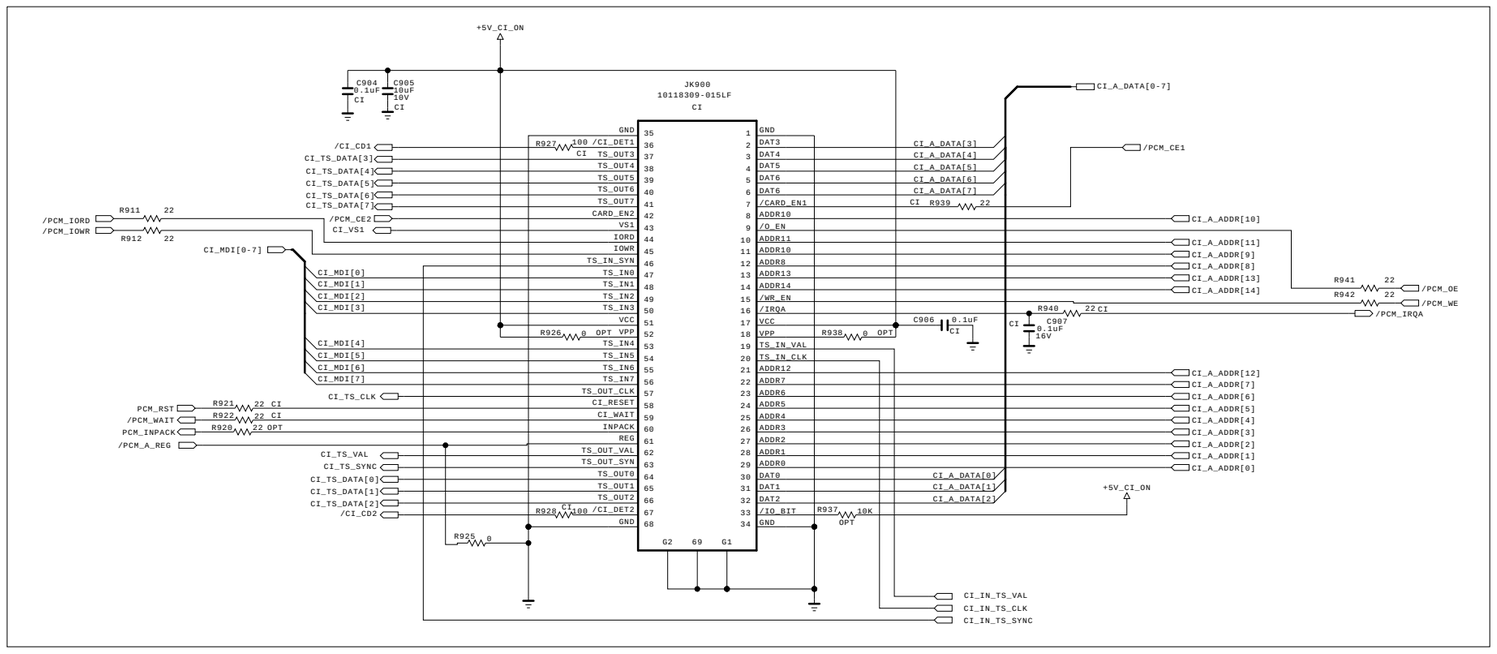

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MODEL	MID_MAIN_CI	DATE	2011.11.21
BLOCK		SHEET	13

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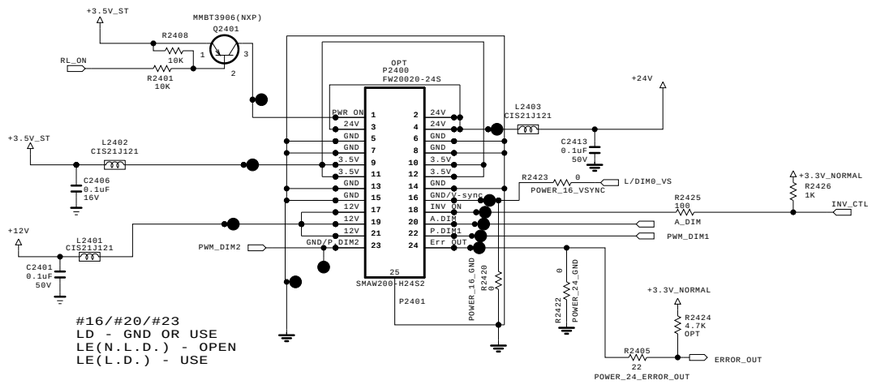
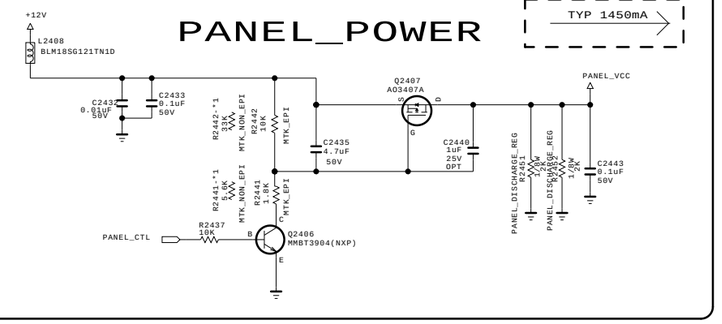
FROM LIPS & POWER B/D



#16/#20/#23
LD - GND OR USE
LE(N.L.D.) - OPEN
LE(L.D.) - USE

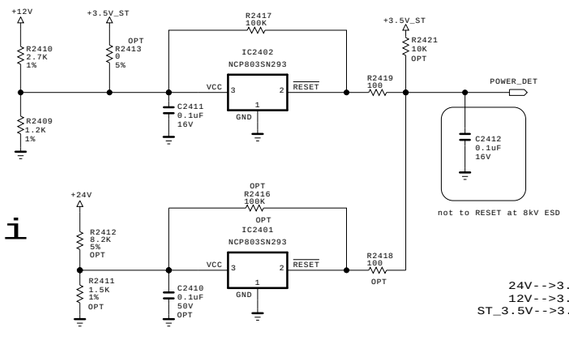
PANEL_POWER

TYP 1450mA



Power_DET

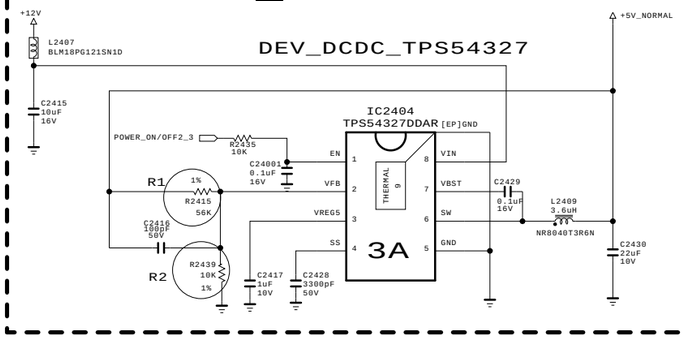
On-semi

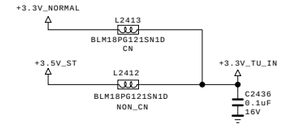


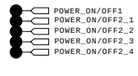
24V-->3.48V
12V-->3.58V
ST_3.5V-->3.5V

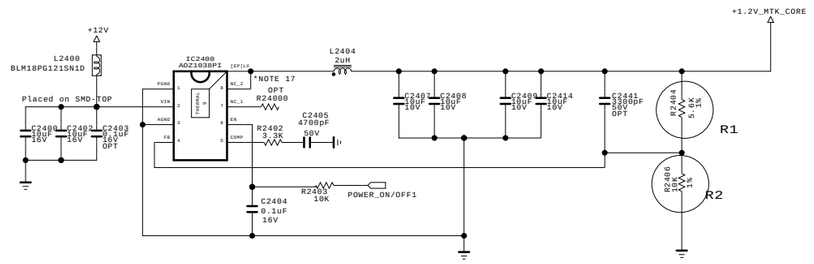
+5V_Normal

DEV_DCDC_TPS54327



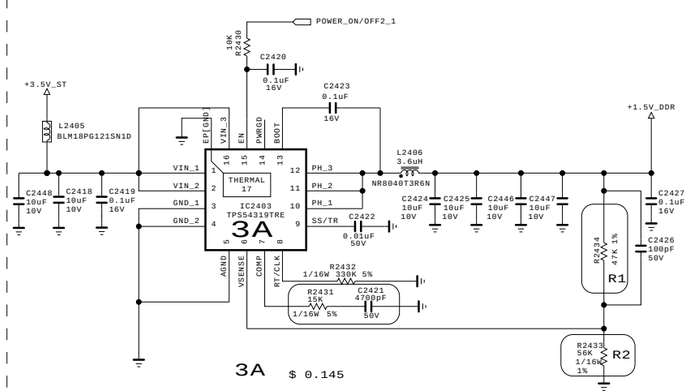






Vout=0.8*(1+R1/R2)

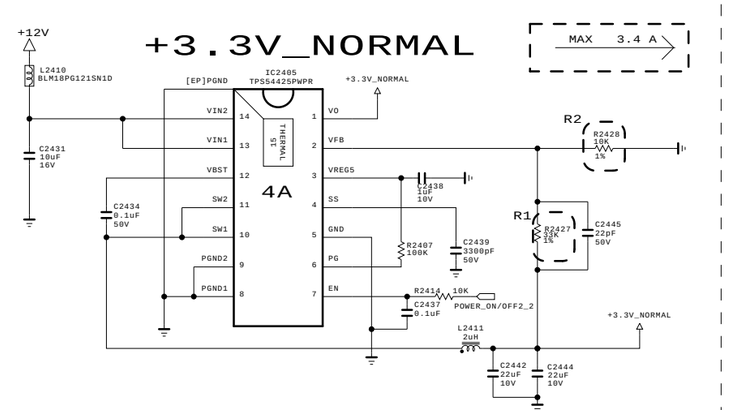
DDR MAIN 1.5V



Vout=0.827*(1+R1/R2)=1.521V

+3.3V_NORMAL

MAX 3.4 A



Vout=(0.763+0.0017*Vout.set)*(1+R1/R2)

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MODEL	MID_POWER	DATE	2011.11.25
BLOCK		SHEET	24

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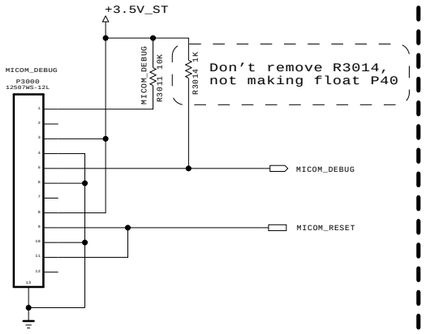
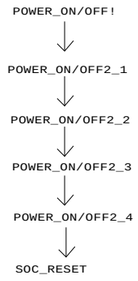
Renesas MICOM

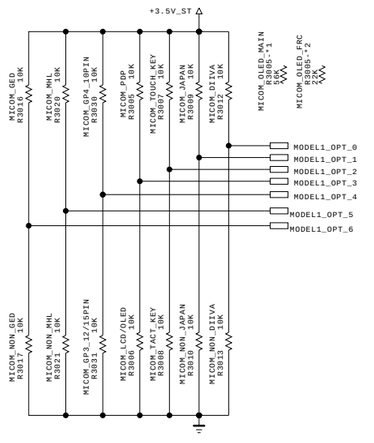
For Debug



GP4 High/MID Power SEQUENCE



MICOM MODEL OPTION

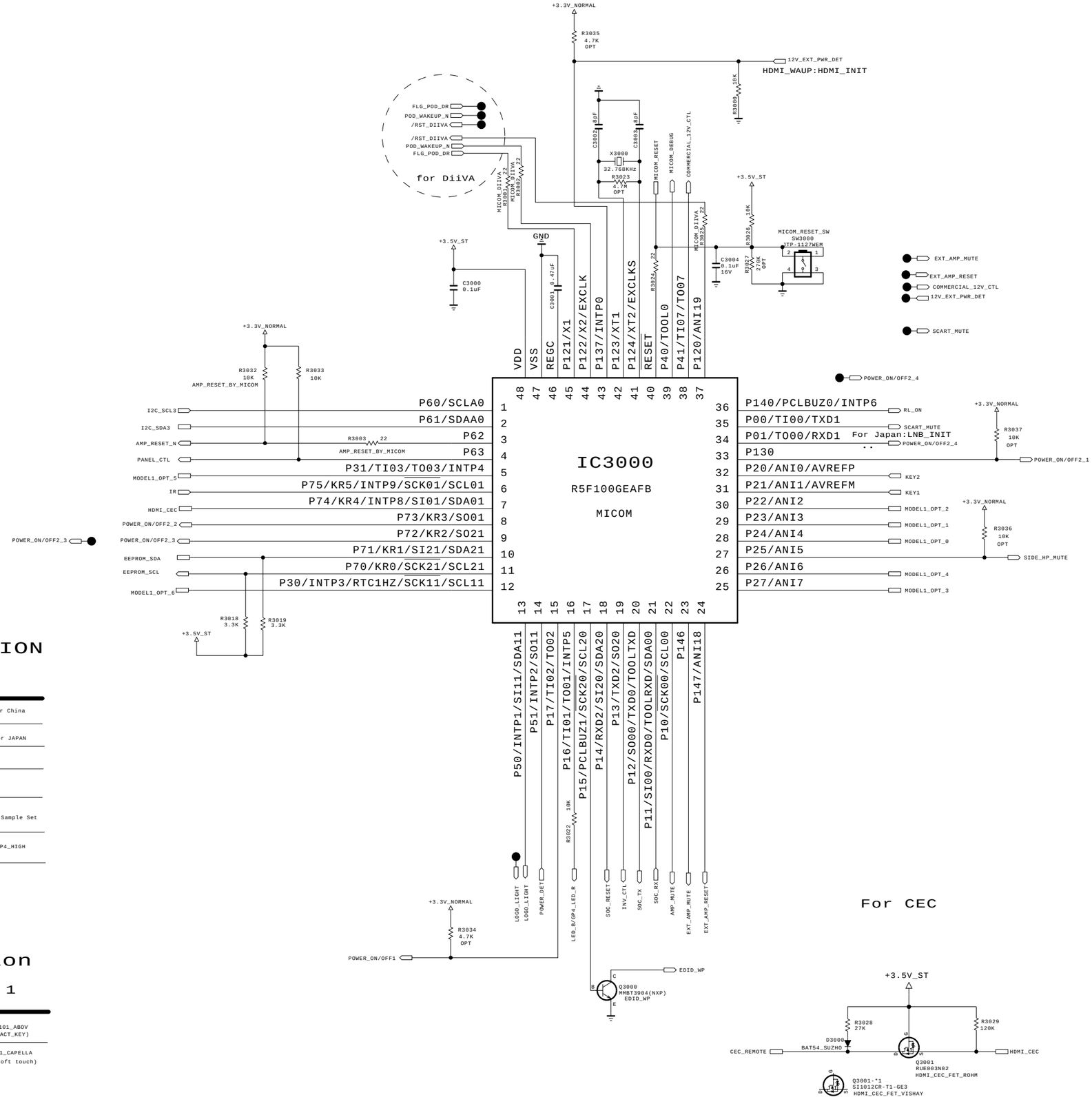


MICOM MODEL OPTION

	0	1	
MODEL_OPT_0	NON DIVA	DIVA	For China
MODEL_OPT_1	NON JAPAN	JAPAN	For JAPAN
MODEL_OPT_2	TACT_KEY	TOUCH_KEY	
MODEL_OPT_3	LCD / OLED	PDP	
MODEL_OPT_4	IR Wafer 12/15Pin (GP3_Soft touch)	IR Wafer 10Pin (GP4_TOOL)	For Sample Set
MODEL_OPT_5	NON_MHL	MHL	GP4_HIGH
MODEL_OPT_6	NON_GED	GED	

Eye Sensor Option

MODEL_OPT_4 / MODEL_OPT_2	0	1
0	N/A	MC8101_ABOV (TACT_KEY)
1	CM3231_CAPELLA (GP3 Soft touch)	CM3231_CAPELLA (GP4 Soft touch)



For CEC

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MODEL		DATE	2011.12.12
BLOCK	MICOM	SHEET	30

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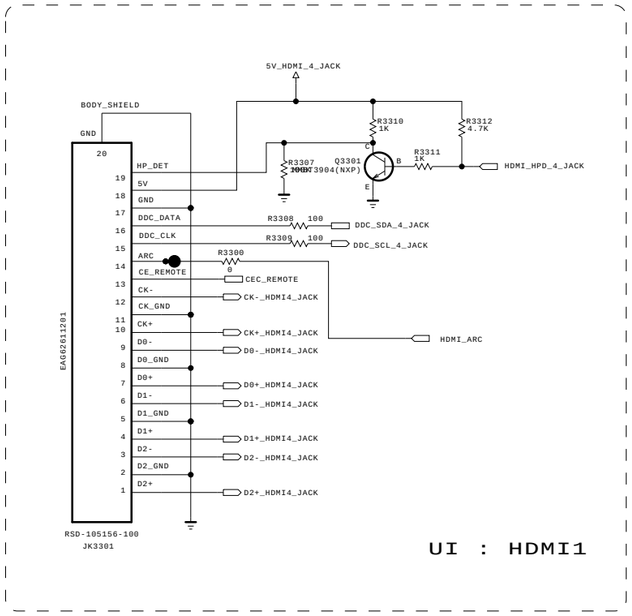

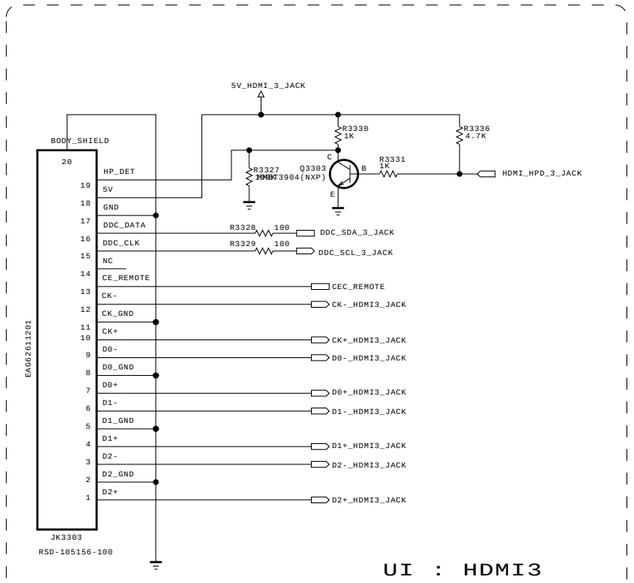

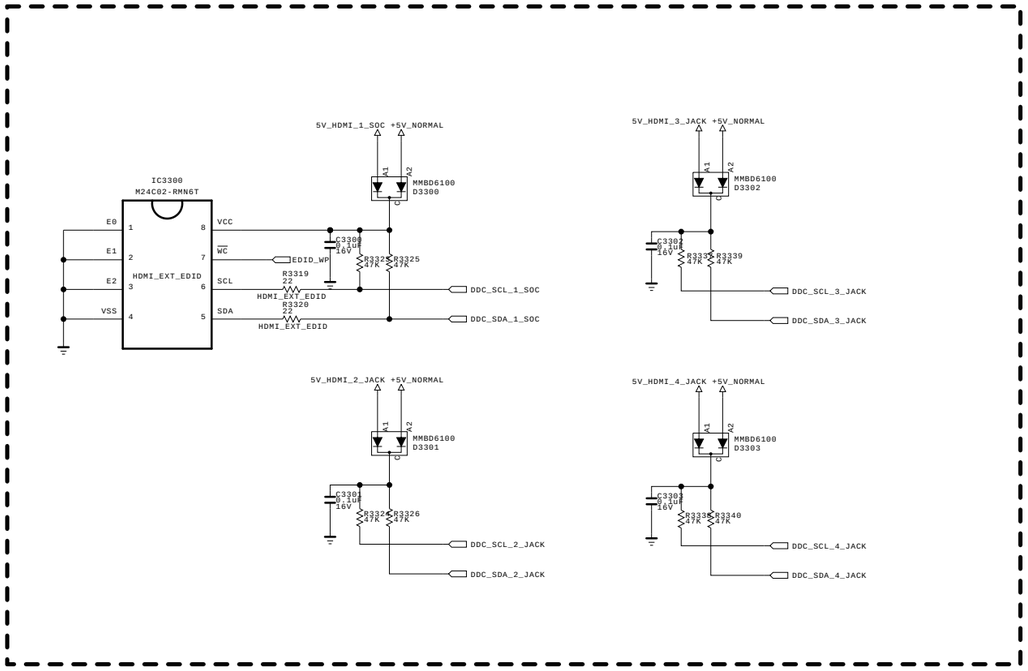

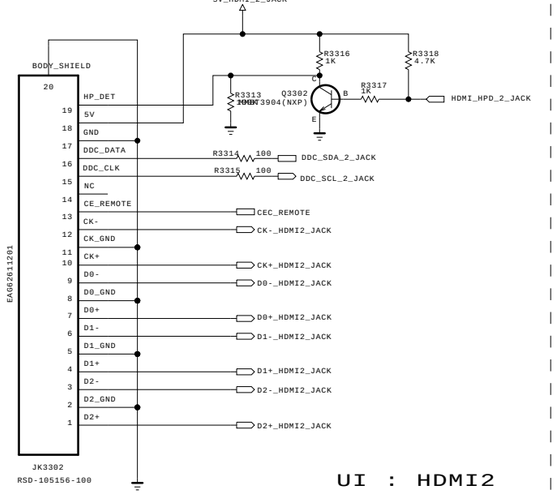

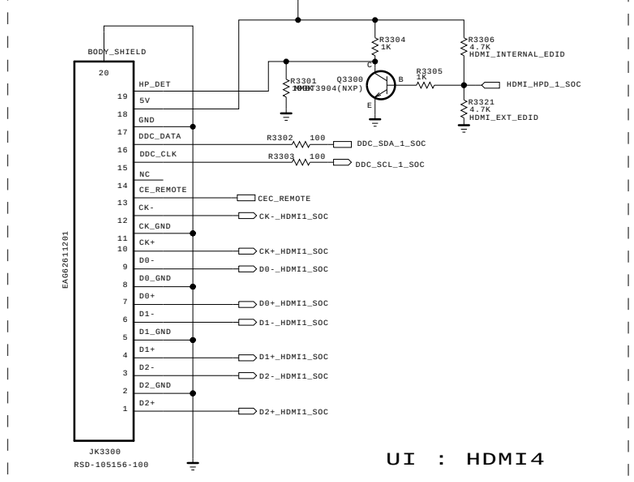

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MODEL	HDMI 4	DATE	2011.10.29
BLOCK		SHEET	33

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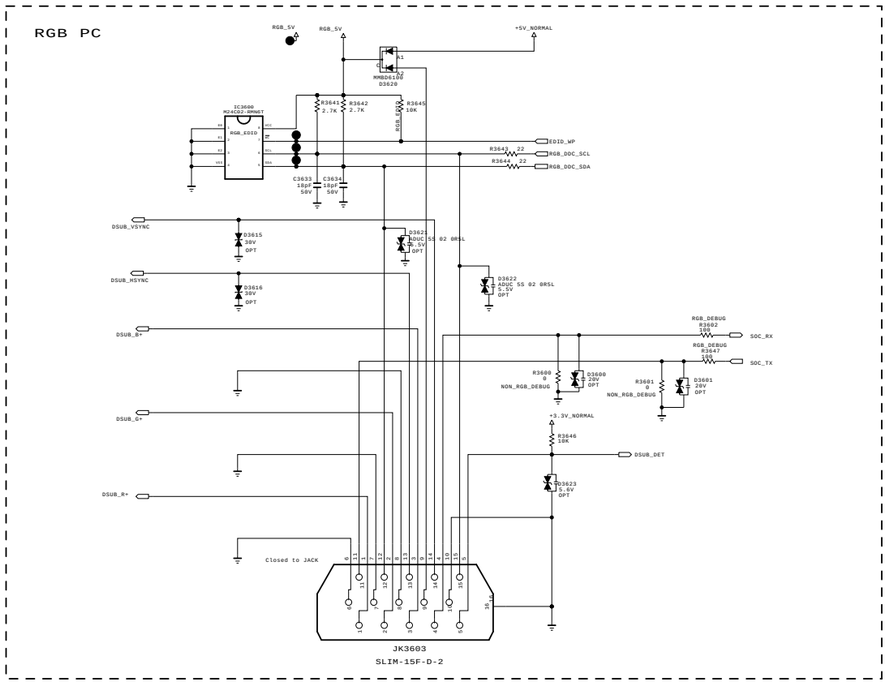
RGB/ PC AUDIO/ SPDIF

RGB PC



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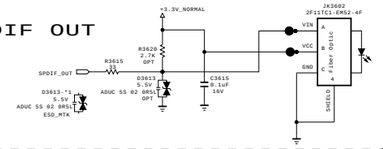
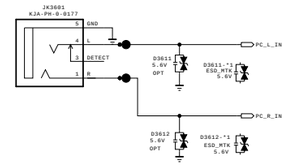


PC AUDIO



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MODEL	JACK HIGH / MID	DATE	2011.11.21
BLOCK		SHEET	36

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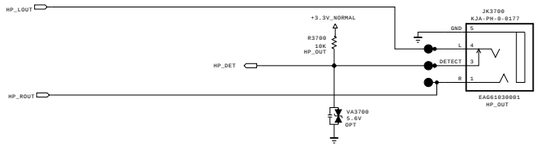

ESD for MTK

ESD for LG1152

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SPECIAL FEATURES IMPORTANT FOR PROTECTION FROM X-RADIATION.
FILRE AND ELECTRICAL SHOCK HAZARDS, WHEN SERVICING IF IS
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MODEL	JACK_COMMON	DATE	2011.11.21
BLOCK		SHEET	37

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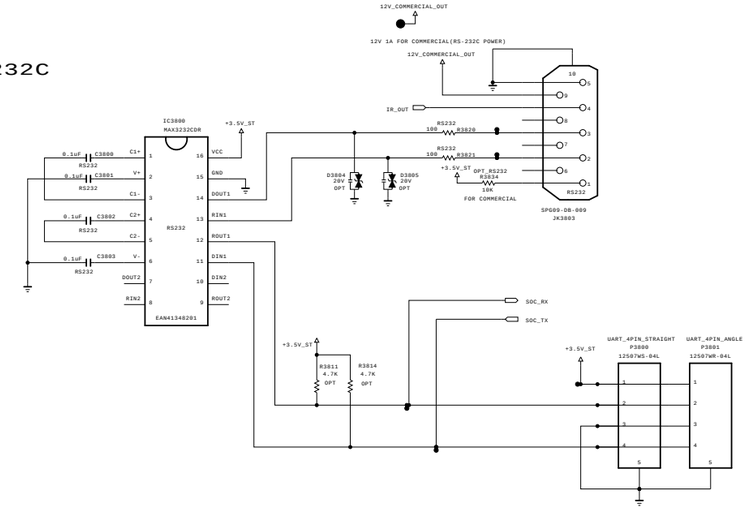
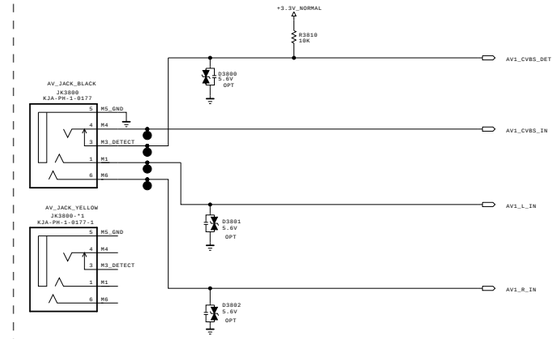
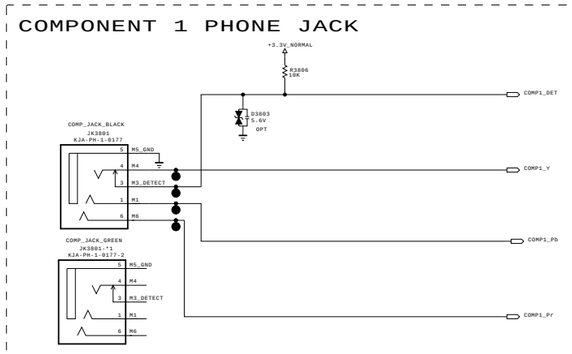
RS232C

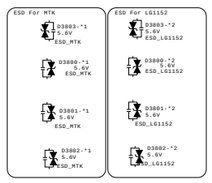


CVBS 1 PHONE JACK



COMPONENT 1 PHONE JACK





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MODEL	JACK_COMMON	DATE	2011.11.21
BLOCK		SHEET	38

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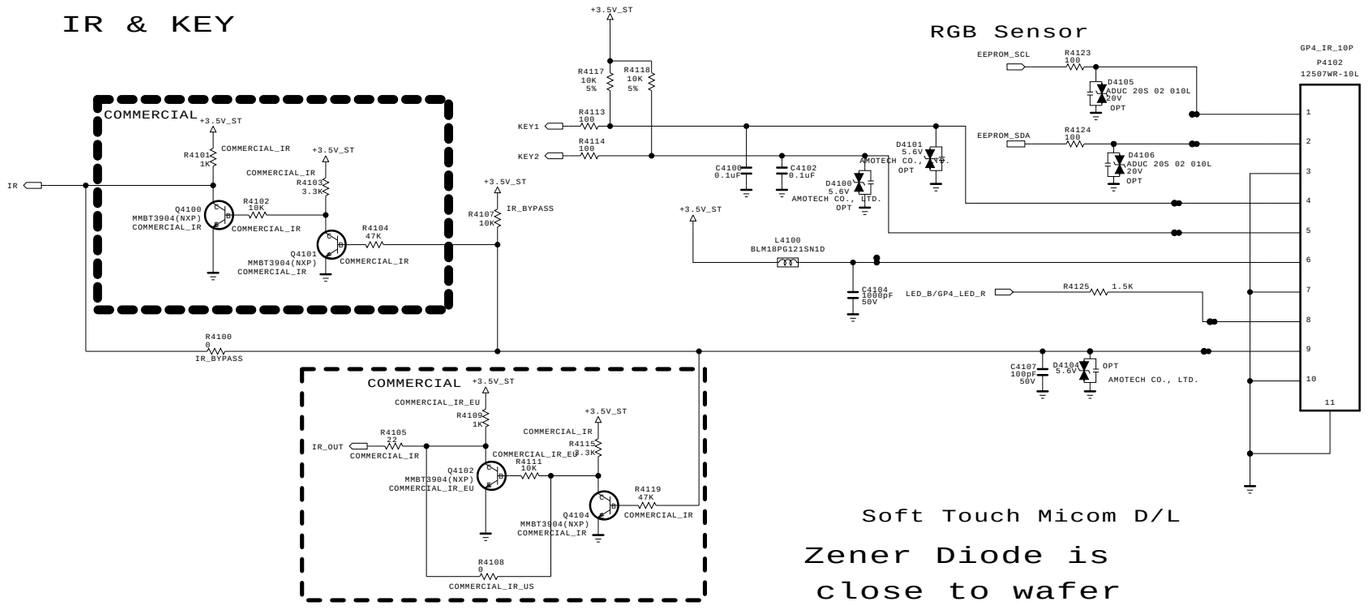
IR & KEY

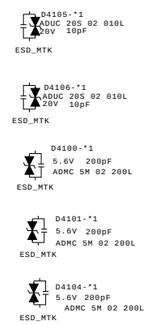


RGB Sensor

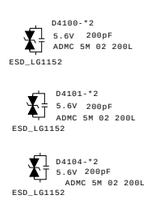
Soft Touch Micom D/L

Zener Diode is close to wafer

ESD for MTK



ESD for LG1152



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LG ELECTRONICS

MODEL	IR / KEY	DATE	2011.11.21
BLOCK		SHEET	41

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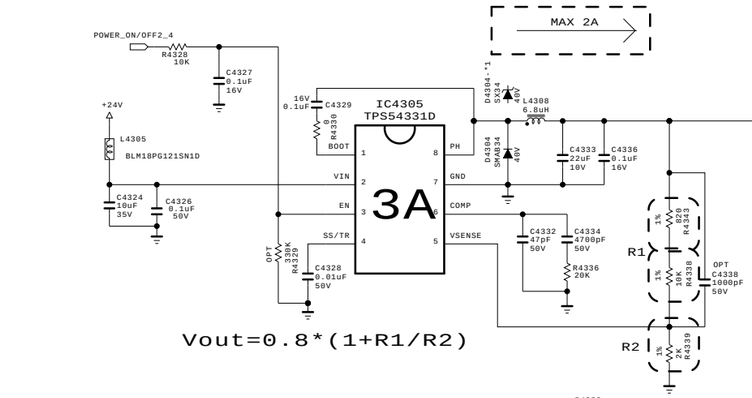
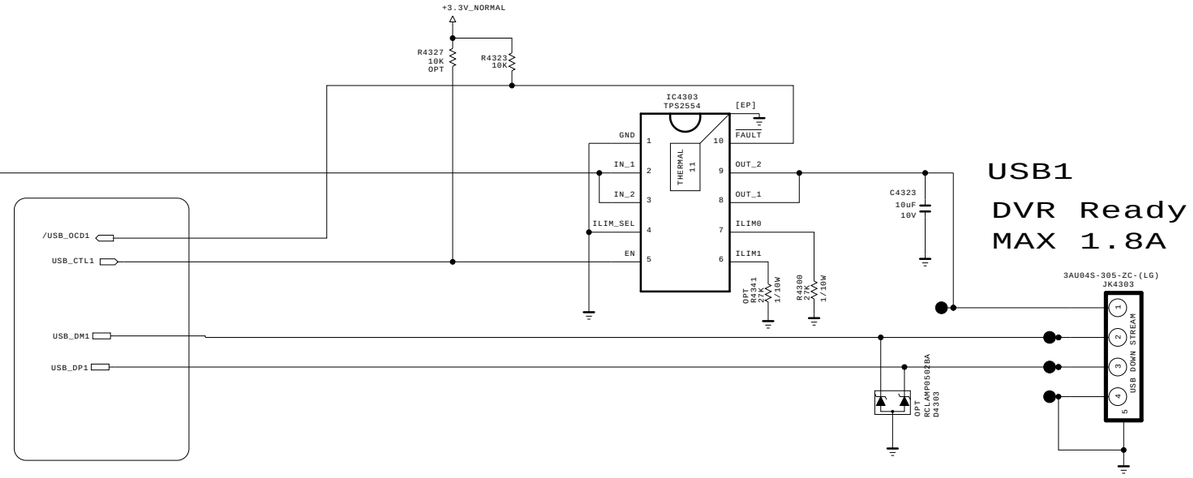
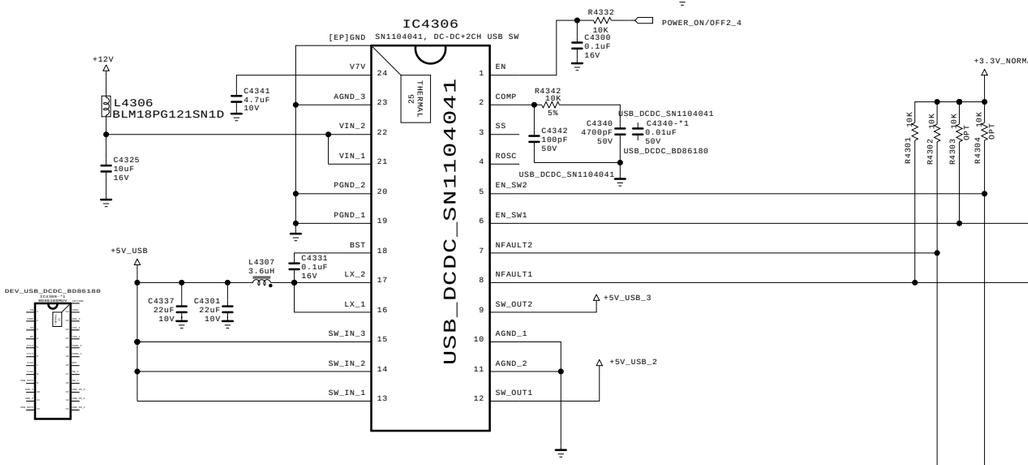
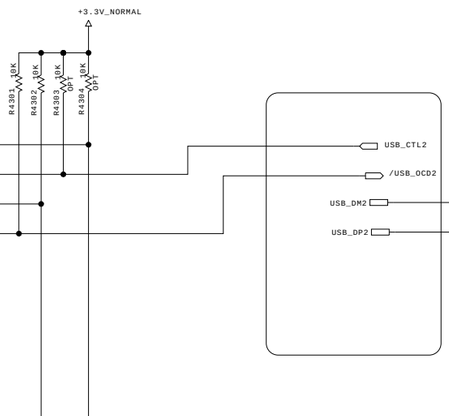
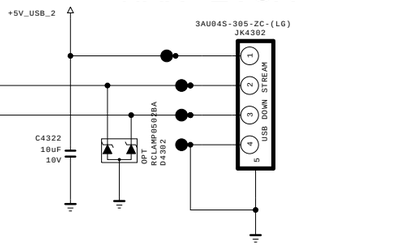
+5V_USB FOR USB1

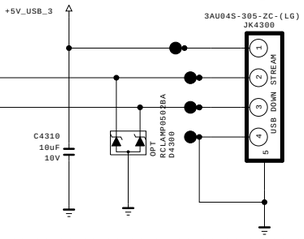


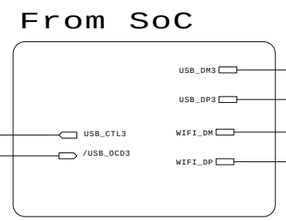


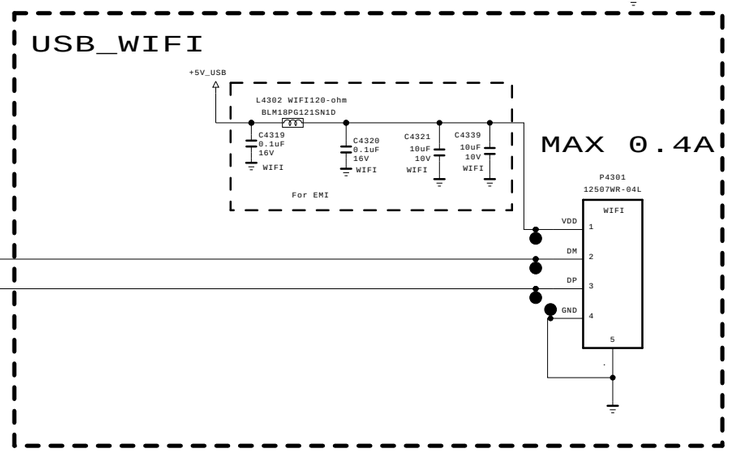






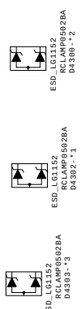






ESD for MTK

ESD for LG1152



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MODEL	USB3_HUB_WiFi	DATE	2011.10.26
BLOCK		SHEET	43

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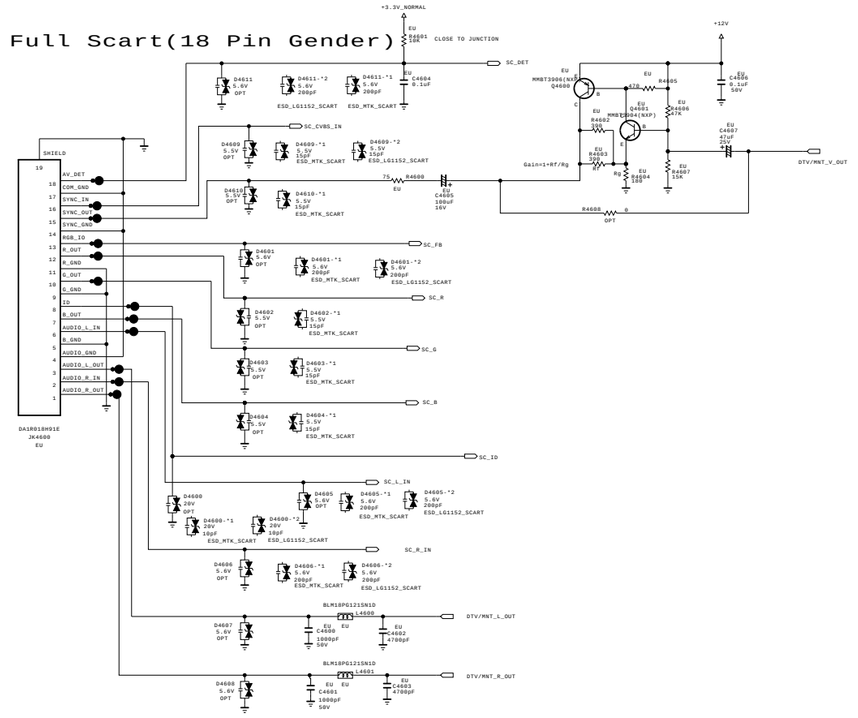
Full Scart(18 Pin Gender)



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MODEL	SCART GENDER	DATE	2011.10.26
BLOCK		SHEET	46

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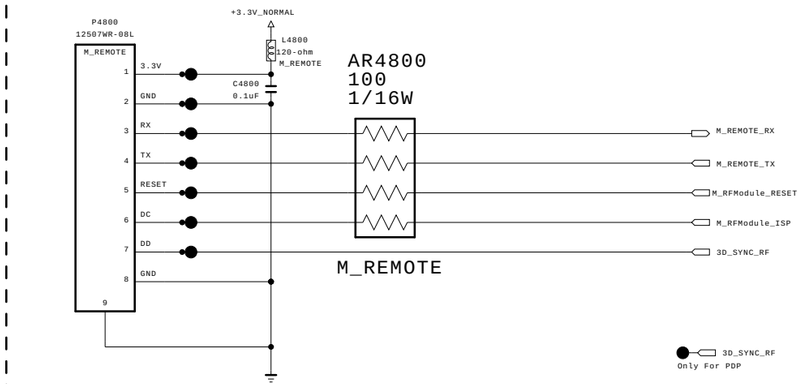
ZigBee_Radio Pulse M_REMOTE OPTION



ALL M_REMOTE OPTION

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MODEL	MOTION REMOTE	DATE	2011.11.21
BLOCK		SHEET	48

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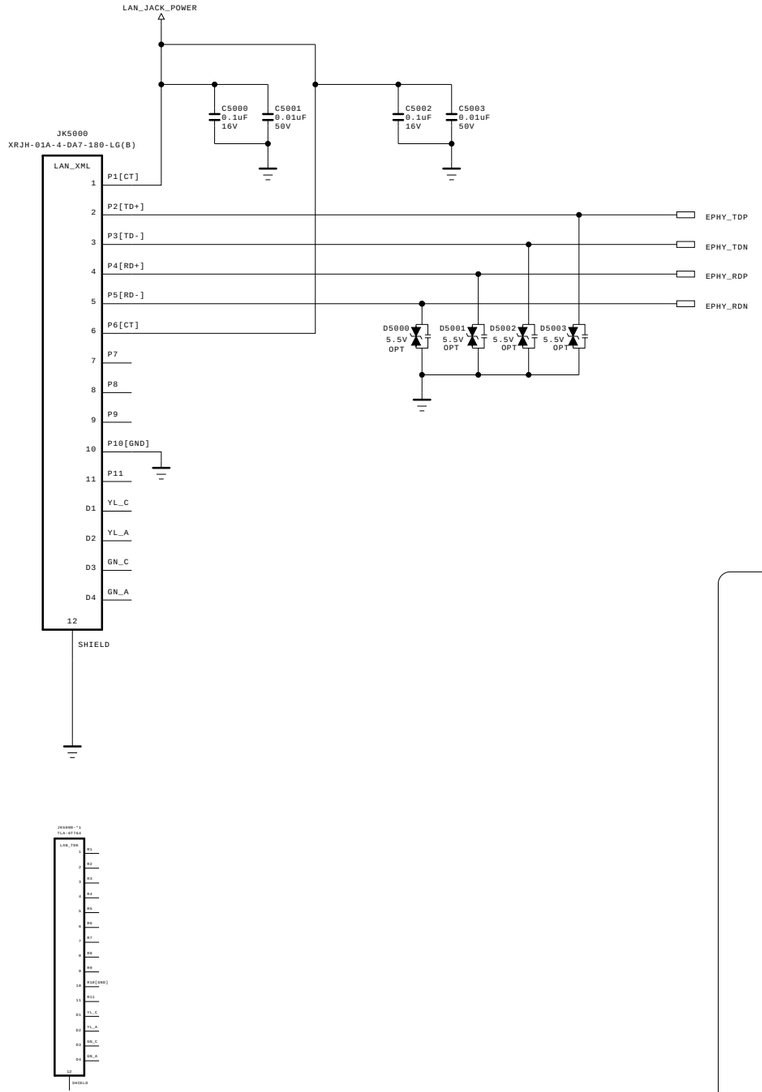
Ethernet Block



ESD for MTK

D5000-*1
ESD_MTK
ADUC 5S 02 0R5L

D5001-*1
ESD_MTK
ADUC 5S 02 0R5L

D5002-*1
ESD_MTK
ADUC 5S 02 0R5L

D5003-*1
ESD_MTK
ADUC 5S 02 0R5L

ESD for LG1152

ESD_LG1152
D5000-*2
5.5V
ADUC 5S 02 0R5L

ESD_LG1152
D5001-*2
5.5V
ADUC 5S 02 0R5L

ESD_LG1152
D5002-*2
5.5V
ADUC 5S 02 0R5L

ESD_LG1152
D5003-*2
5.5V
ADUC 5S 02 0R5L

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MODEL	LAN_VERTICAL	DATE	2011.12.09
BLOCK		SHEET	50

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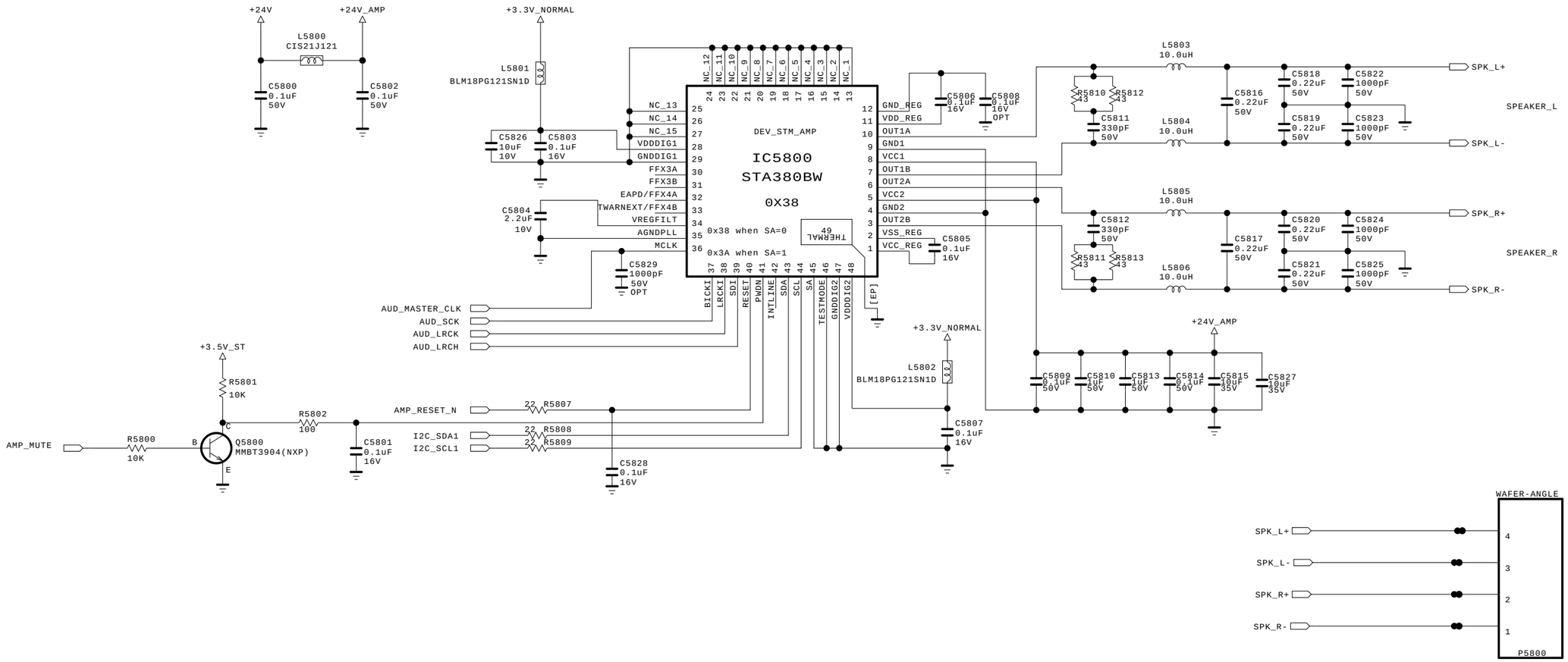

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MODEL	GP4_MT5369	DATE	2011.11.21
BLOCK	AUDIO[ST]	SHEET	58

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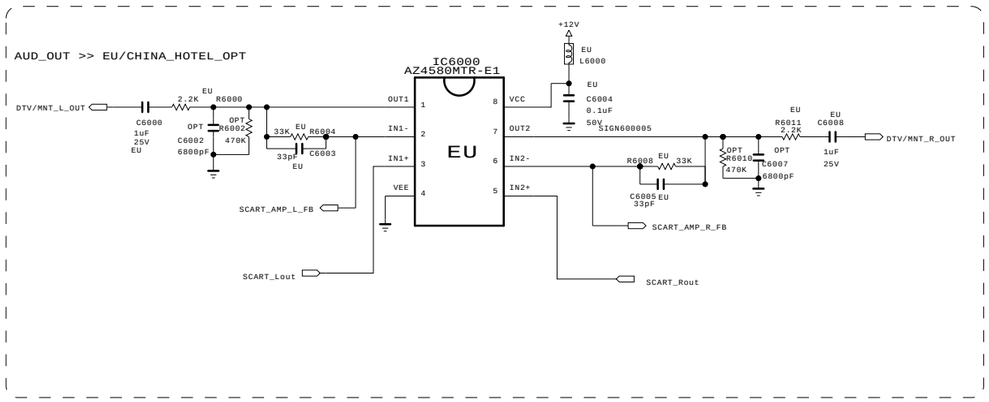

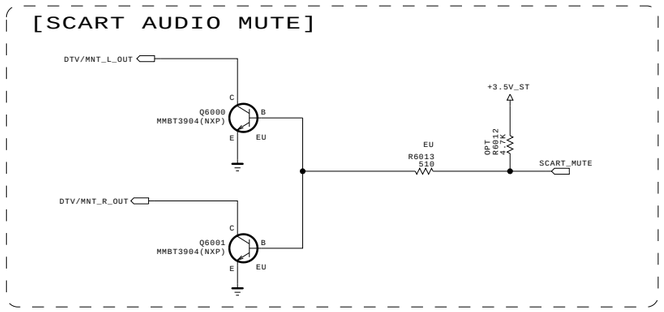

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MODEL	SCART AUDIO AMP	DATE	2011.11.21
BLOCK		SHEET	60

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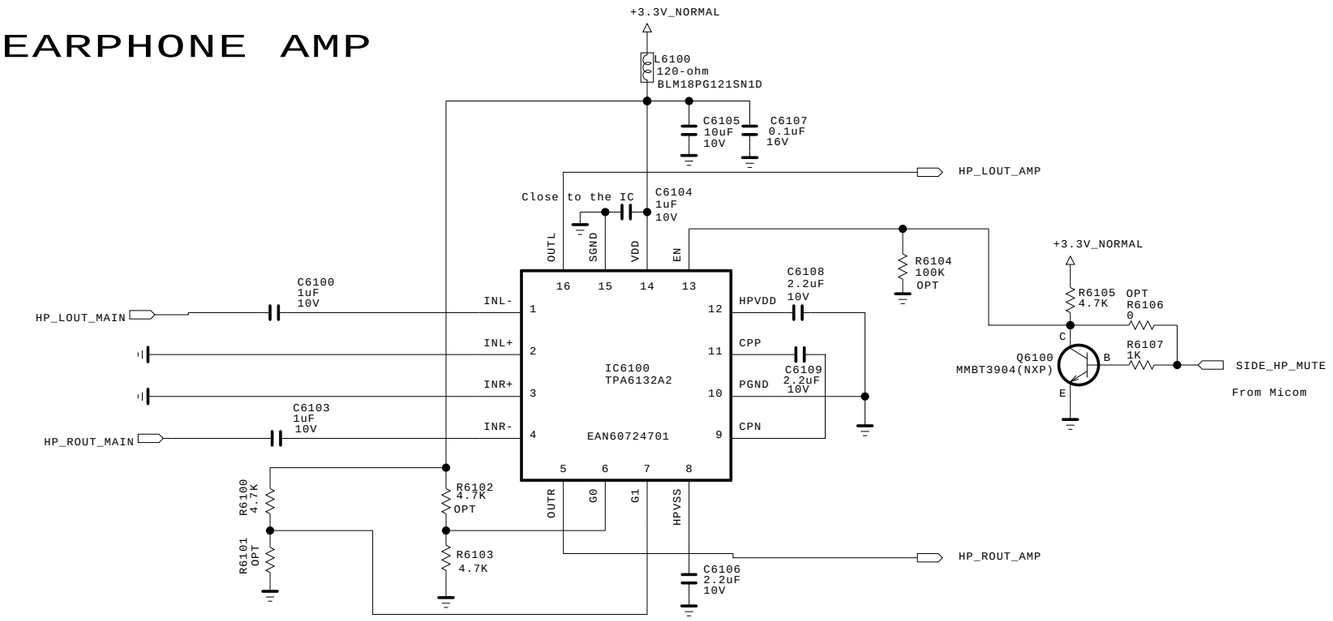
EARPHONE AMP



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MODEL	HEADPHONE AMP	DATE	2011.09.29
BLOCK		SHEET	61

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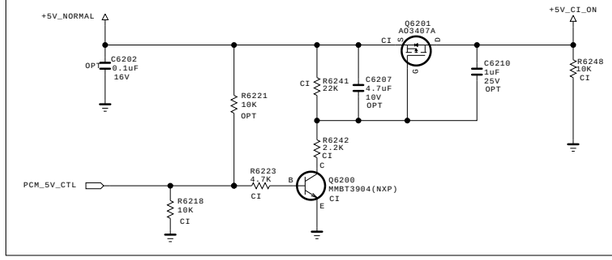
CI POWER ENABLE CONTROL



Option FOR MTK

C6210-*1
1uF
25V
CI_MTK

Option FOR LG1152

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MODEL	CI SLOT	DATE	2011.10.31
BLOCK		SHEET	62

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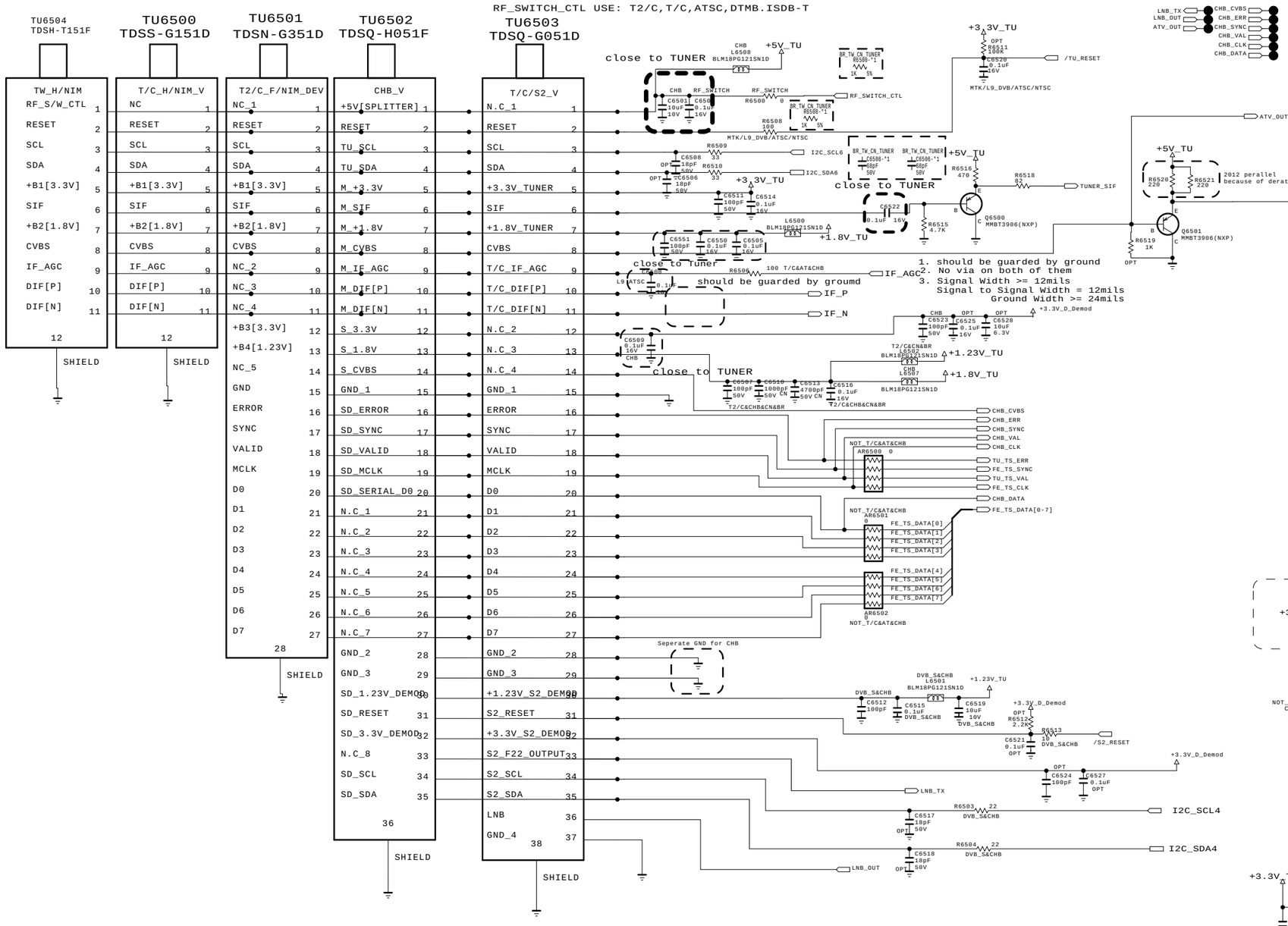
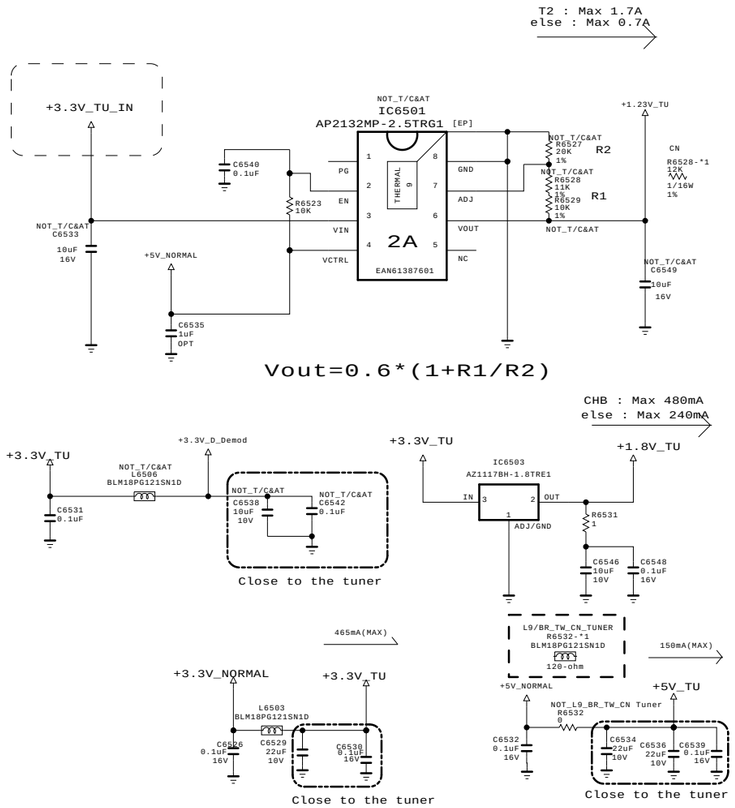
T/C/S & H/NIM & T2/C TUNER(EU & CHINA)



T/C_H/NIM	T/C/S2	T2/C_F/NIM	T2/C/S2	CHB	AT_H/NIM	CN	BR
T/C&AT&CHB	DVB_S	NOT_T/C&AT	DVB_S	CHB	T/C&AT&CHB	CN	
NOT_DVB_S	DVB_S&CHB	T2/C	DVB_S&CHB	DVB_S&CHB	NOT_DVB_S	NOT_T/C&AT	
Not_L9_T2/C/S	NOT_T/C&AT	T2/C&CN	NOT_T/C&AT	NOT_T/C&AT	Not_L9_T2/C/S	RF_SWITCH	
	T/C&AT&CHB	T2/C&CHB&CN	T2/C	T/C&AT&CHB		NOT_T/C&AT&CHB	
	NOT_T/C&AT&CHB	NOT_T/C&AT&CHB	T2/C&CN	T2/C&CHB&CN		NOT_DVB_S	
	Not_L9_T2/C/S	NOT_DVB_S	T2/C&CHB&CN	H/NIM&CHB		Not_L9_T2/C/S	
		Not_L9_T2/C/S	NOT_T/C&AT&CHB	Not_L9_T2/C/S			
			L9_T2/C/S				



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MODEL	TUNER	DATE	2011.11.21
BLOCK		SHEET	65

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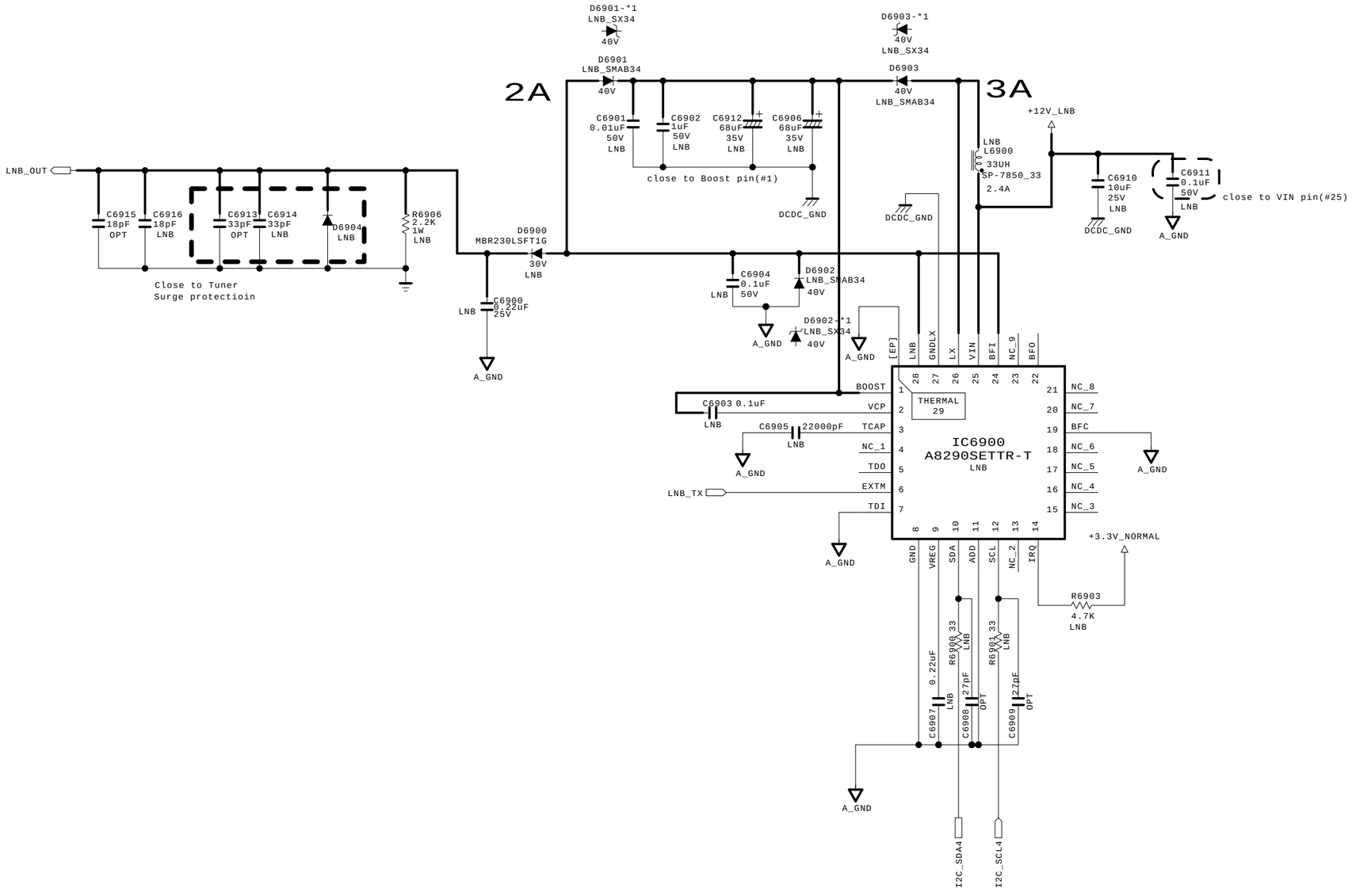
DVB-S2 LNB Part Allegro

(Option:LNB)

DCDC_GND and A_GND are connected
DCDC_GND and A_GND are connected in pin#27
PCB_GND and A_GND are connected

Input trace widths should be sized to conduct at least 3A
Ouput trace widths should be sized to conduct at least 2A



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MODEL	LNB	DATE	2011.11.21
BLOCK		SHEET	69

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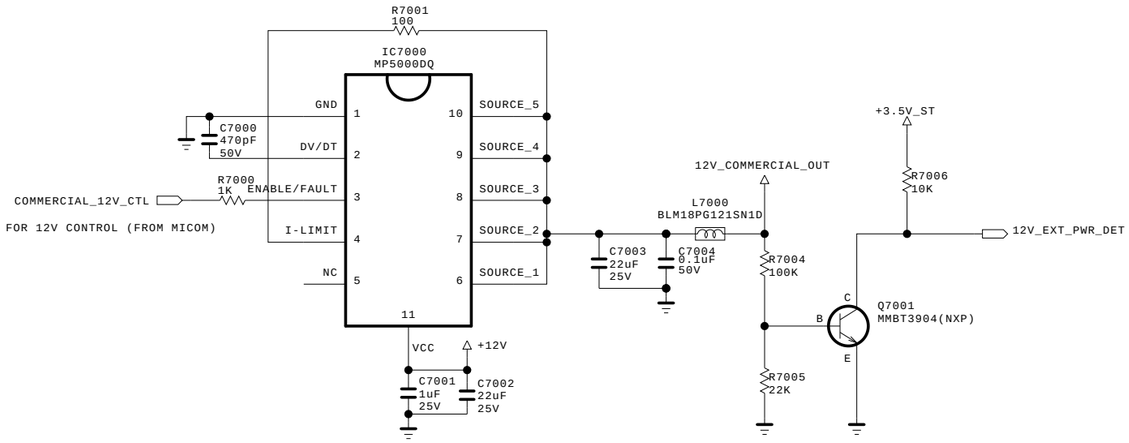
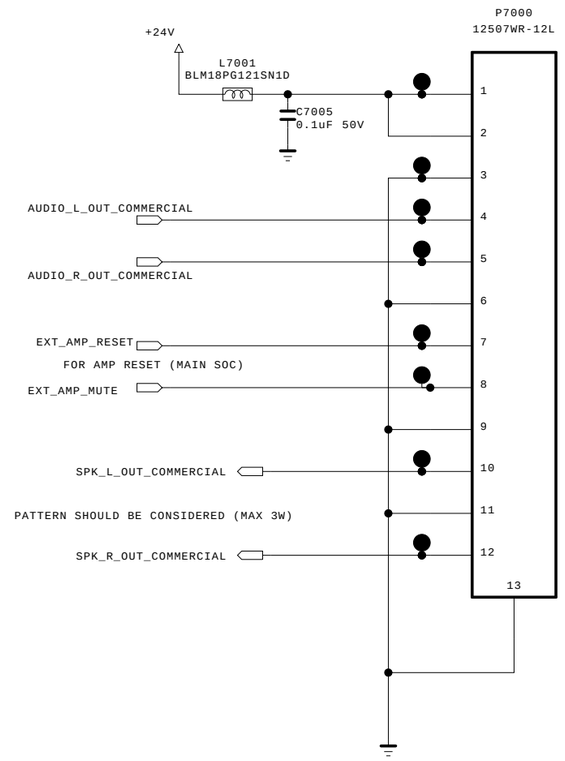
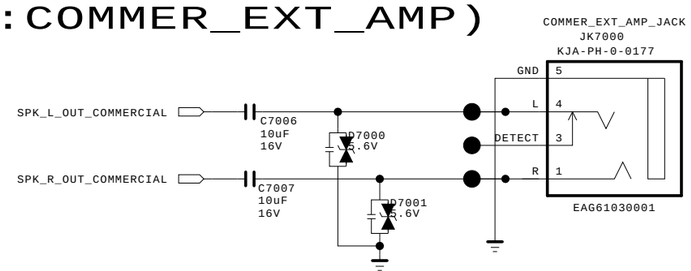
FOR COMMERCIAL 12V OUT RS-232C 9 PIN (OPT:COMMER_EXT_12V)



FOR COMMERCIAL AUDIO OUT (OPT:COMMER_EXT_AMP)



AUDIO OUT JACK (OPT:COMMER_EXT_AMP)



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MODEL	COMMERCIAL_OPTION	DATE	2011.11.21
BLOCK		SHEET	70

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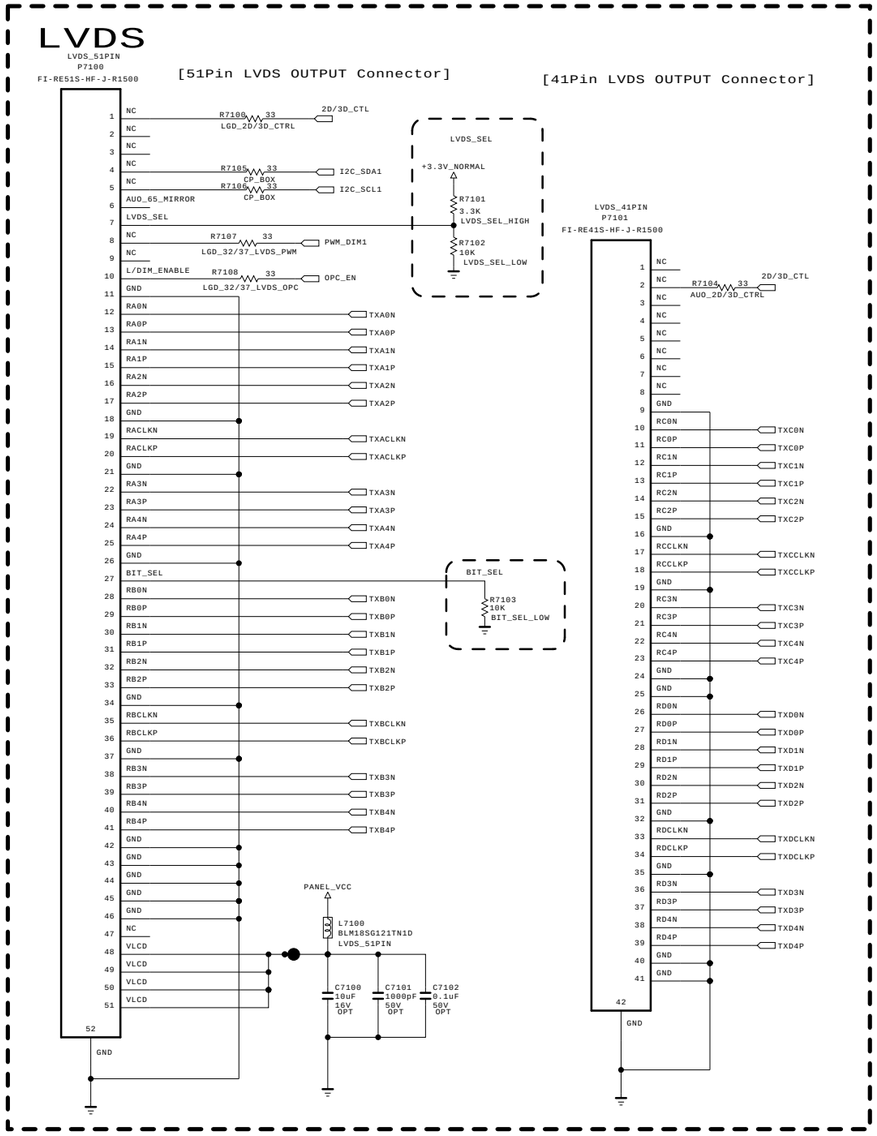
LVDS



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MODEL	LVDS_HIGH_MID	DATE	2011.08.11
BLOCK		SHEET	71

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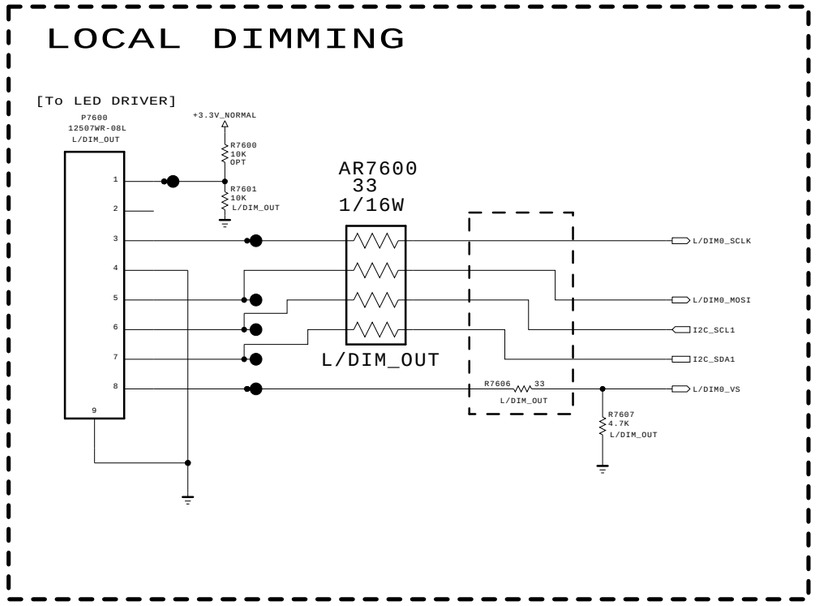
LOCAL DIMMING



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MODEL	LOCAL DIMMING	DATE	2011.12.13
BLOCK		SHEET	76

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<POWER BLOCK>

THIS IS REVERSE PATTERN !!!!

[Left Source(51PIN LOCATION)]

[Right Source(41PIN LOCATION)]

<LEVEL SHIFTER BLOCK>

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MODEL		DATE	2011.12.01
BLOCK	T-Con	SHEET	77

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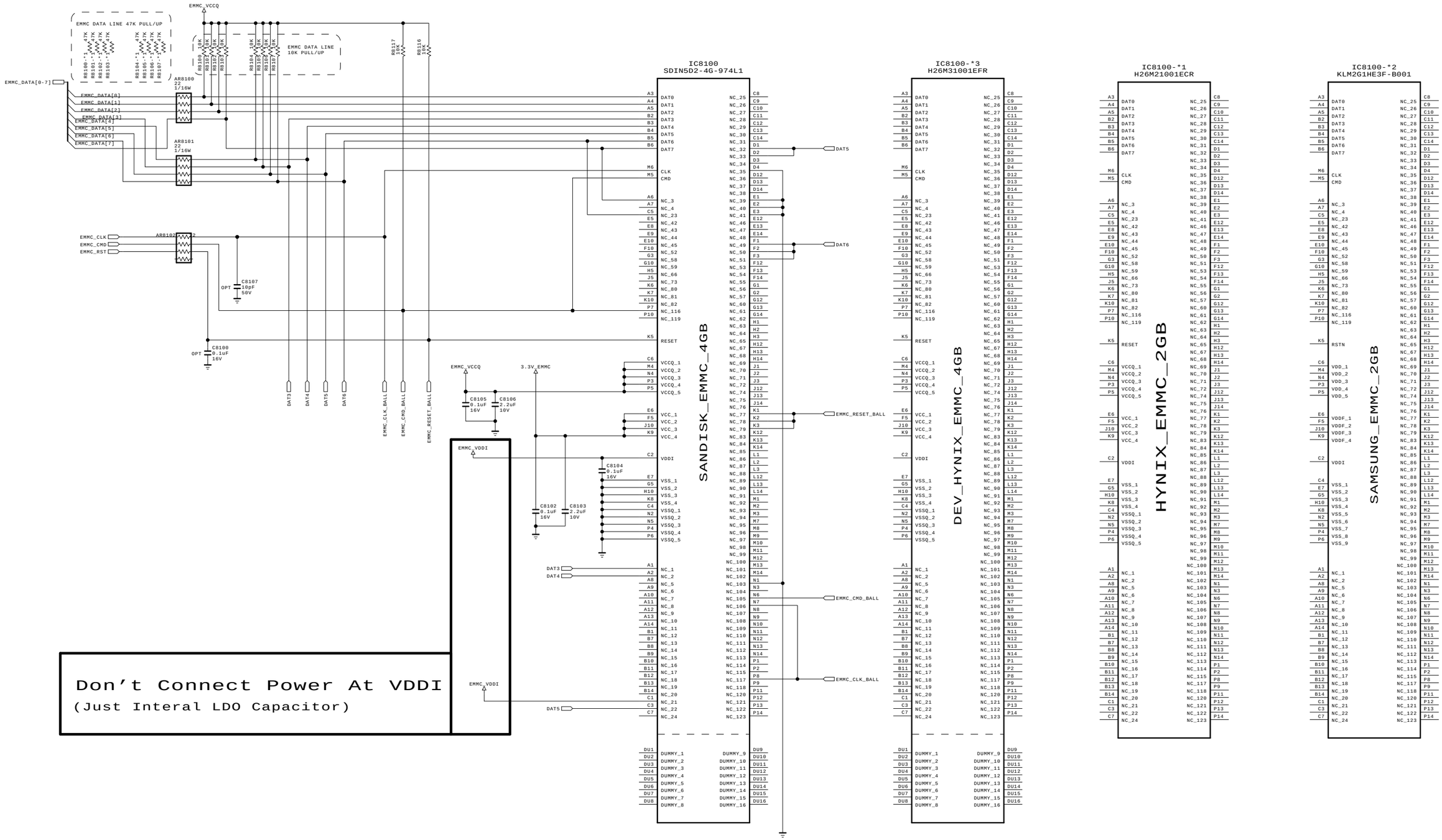
eMMC I/F



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MODEL	eMMC	DATE	11.09.29
BLOCK		SHEET	81

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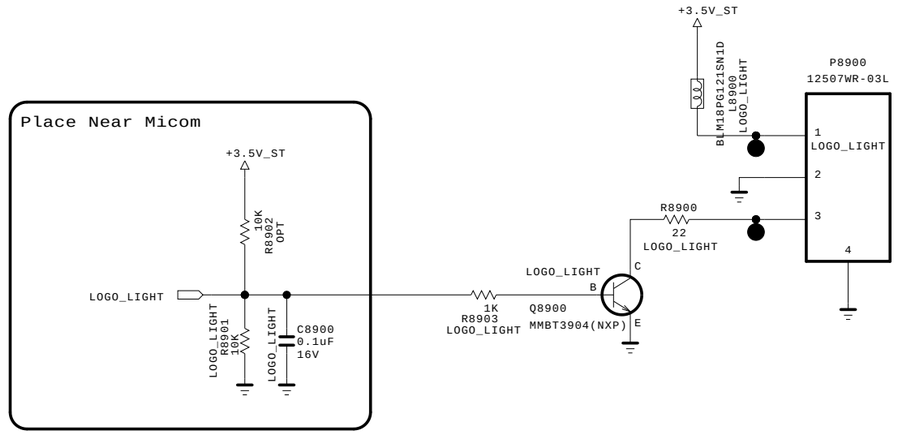

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MODEL		DATE	
BLOCK		SHEET	/

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LG
Life's Good

2012 LED/LCD TV
Engineering guide

< Applicable Model >
XXLM760S-ZB

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◈ CONTENT ◈

New features

Main PCBs

Block Diagrams, IIC Map

Structure of TV set and connection of sub ass'ys

New sub ass'ys

- Instruction of new sub ass'ys
- How to use tool
- Download

Adjust way of new features (widevine…)

Repair guide

The latest issue and concerning issue

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EPI Interface

- EPI(Embedded Point-Point Interface)
- Features
  - **Point-Point topology (support 2 Pair option)**
  - **CDR (Clock Data Recovery)**
  - **Bandwidth up to 1.85Gbps/pair at FHD 120Hz 10 bit application**
  - **Lock signal cascading and feedback to T-Con**
  - **Embedded Control Data**
- Merits
  - **Better reliability on common noise**
  - **No data skew and better EMI margin**
  - **Fewer lines than mini-LVDS**
  - **Slim PCB design**

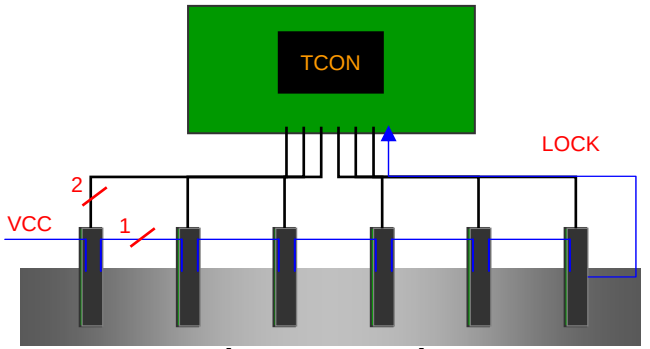

Figure1. Topology

Table 1. Example of FHD 120Hz TV

EPI	FHD (10bit) @ 960Ch		
	60Hz	120Hz	240Hz
Transmission Line	12	12	24
Bandwidth	0.84Gbps	1.68Gbps	1.68Gbps

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EPI Interface (mini-LVDS vs. EPI)

Comparison

HF mini-LVDS

HF mini-LVDS	FHD (10bit)		
	60Hz	120Hz	240Hz
No. of Signal	36	36	72
Connector	60pin (2ea)	60pin (2ea)	80pin (2ea)

-Difficult to upgrade bandwidth limit
-Multiple number of wires needed for higher bandwidth

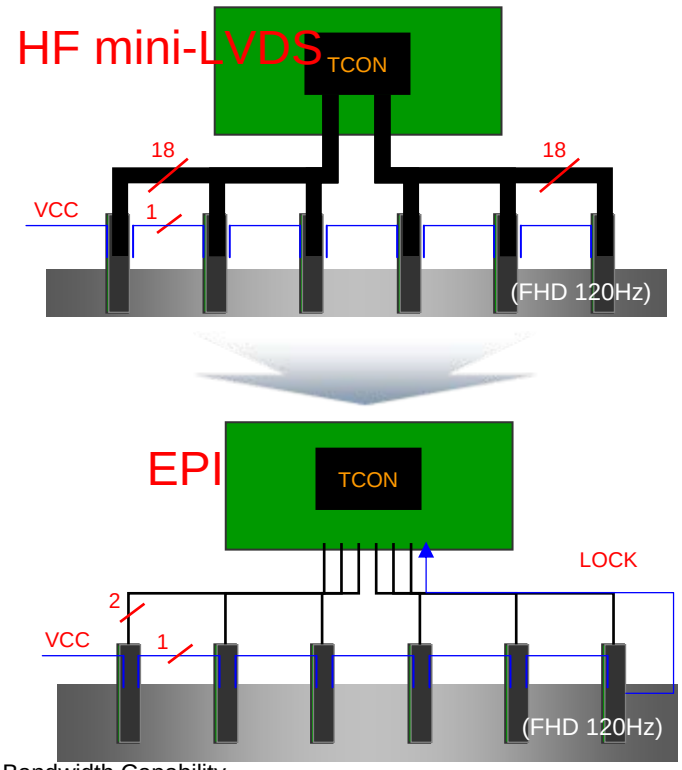
EPI (Embedded clock P-to-P Interface)

EPI	FHD (10bit)		
	60Hz	120Hz	240Hz
	960ch	960ch	720ch
No. of Signal	12	12	32
Connector	-	50 pin (2ea)	70pin (2ea)

-Better reliability on common noise
-No data skew. Better EMI margin
-Lower cost (Cable, Connector)
-Slim S-PCB design (14mm → 10mm) helps slimmer TV

What to change

LCM (T-con to S-Driver IC)



* Bandwidth Capability
- FHD 120Hz 10Bit : 594Mbps@36Lines → 1.65Gbps@12Lines
- FHD 240Hz 10Bit : 594Mbps@72Lines → 1.25Gbps@32Lines

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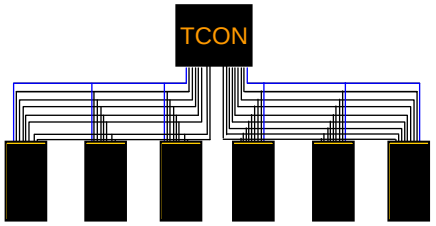
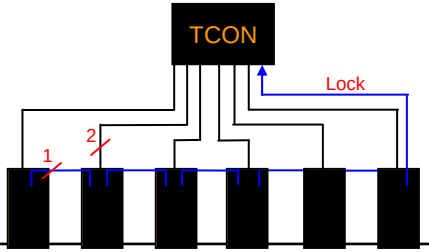
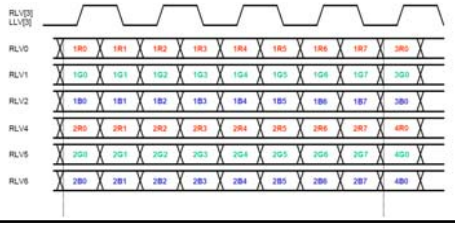
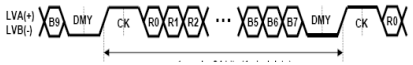
EPI Interface (mini-LVDS vs. EPI)

	HF mini-LVDS	EPI
Topology		
Protocol		 Bit / Name / Description 0, 1 / CK / Indicates a rising edge of bit clock. (Always "H") 2 ~ 30 / - / RGB data are transmitted. LSB is transmitted at first. 2 ~ 11 : R0 ~ R9 12 ~ 21 : G0 ~ G9 22 ~ 31 : B0 ~ B9 32, 33 / DMY / Dummy (Always "L")
Features **@10bit, FHD120**	• Multi Drop • Data rate: 660Mbps • External clock	• Point to Point • Data rate : 1.8Gbps • Embedded clock, Control
Merit	• Simple structure • Standardization	• Fewer Lines : 12 • Embedded clock : low EMI, Clock skew free • Easy to PCB design
Demerit	• Too many lines : 36 • Clock skew • EMI due to clock lines • Bandwidth limit	• Transmission Overhead : 4bit delimiter

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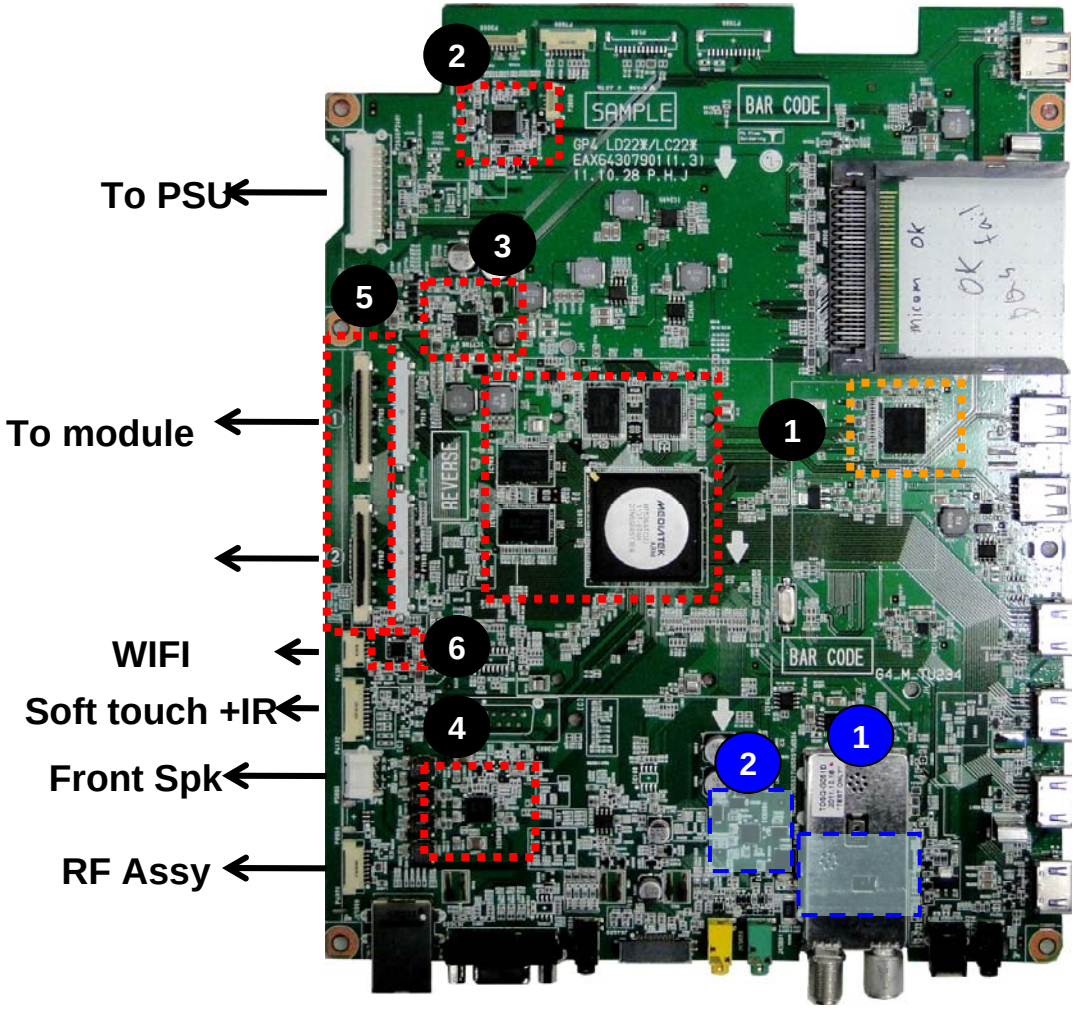
Main PCB for Broadband

Main + TCON all in one

xxLM760S-ZB

Chassis : LD22E
PCB P/No : EAX64307905



G/S model

LNB IC
Only G/S model

1. Main processor, DDR Memory eMMC Memory
2. Micom for Key/IR sensing
3. PMIC
4. Audio AMP (10W+10W)
5. EPI Wafer
6. Level shifter

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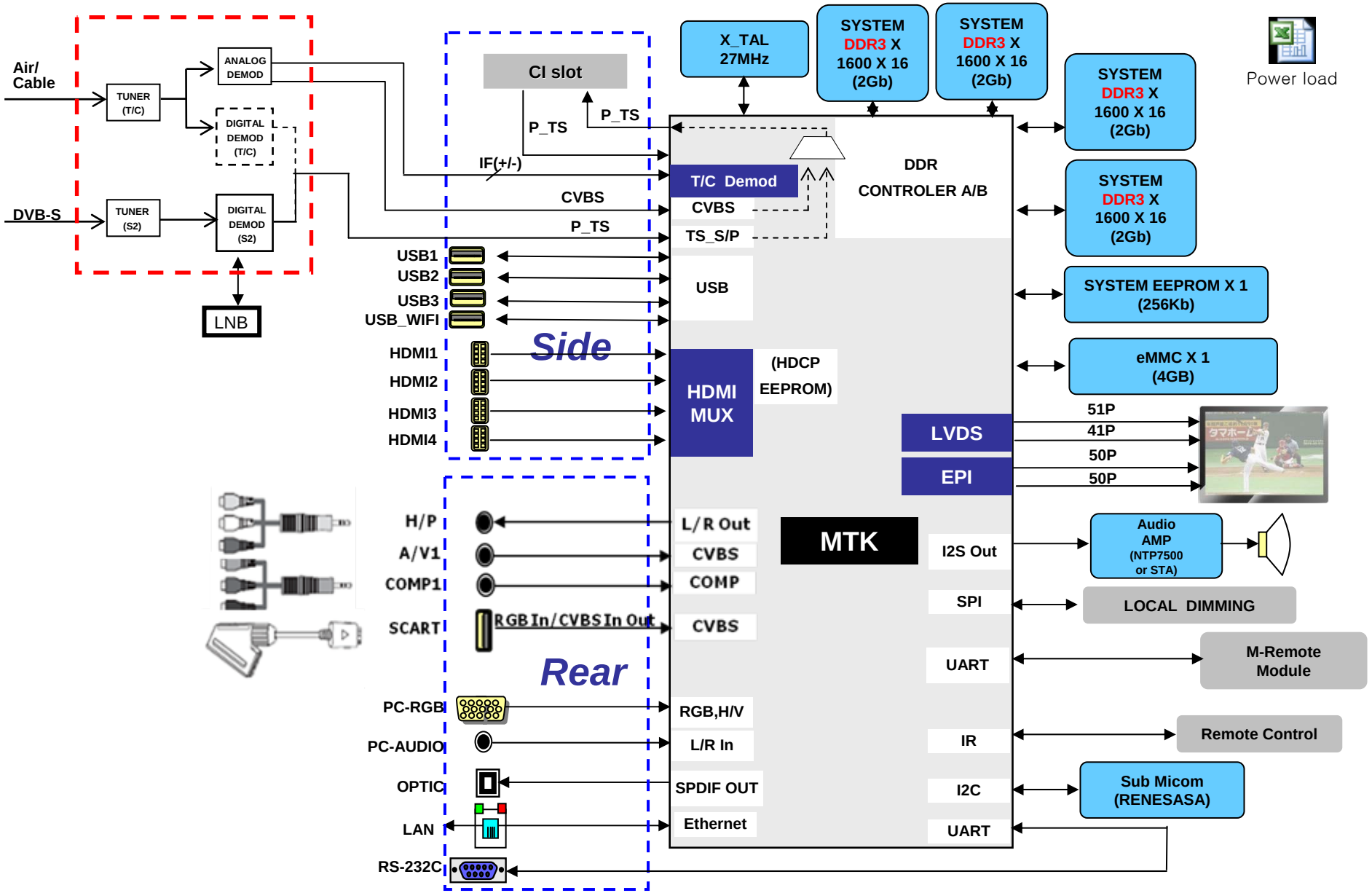
MTK5369 Block Diagram(LM76)



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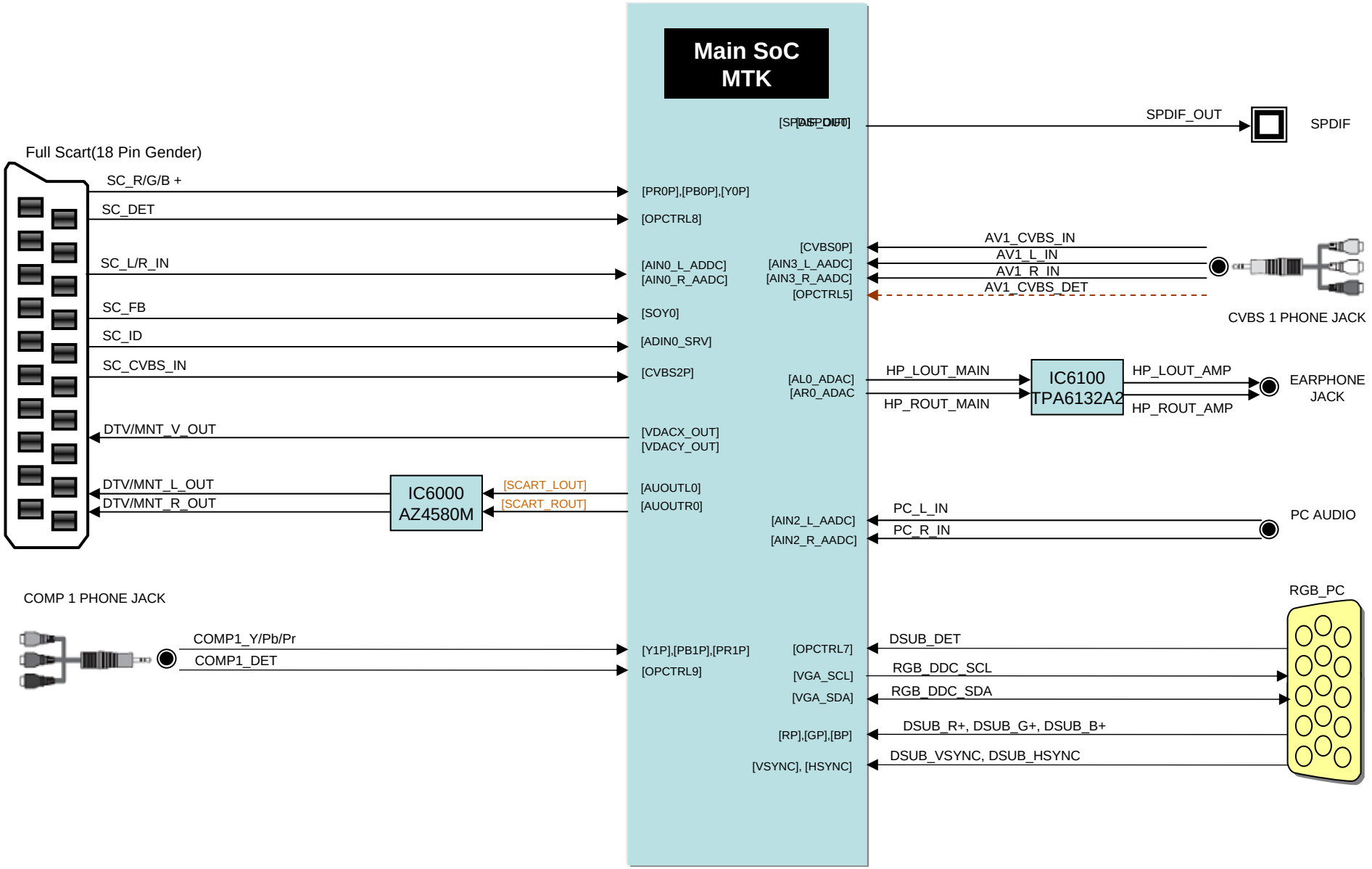
Jack Interface



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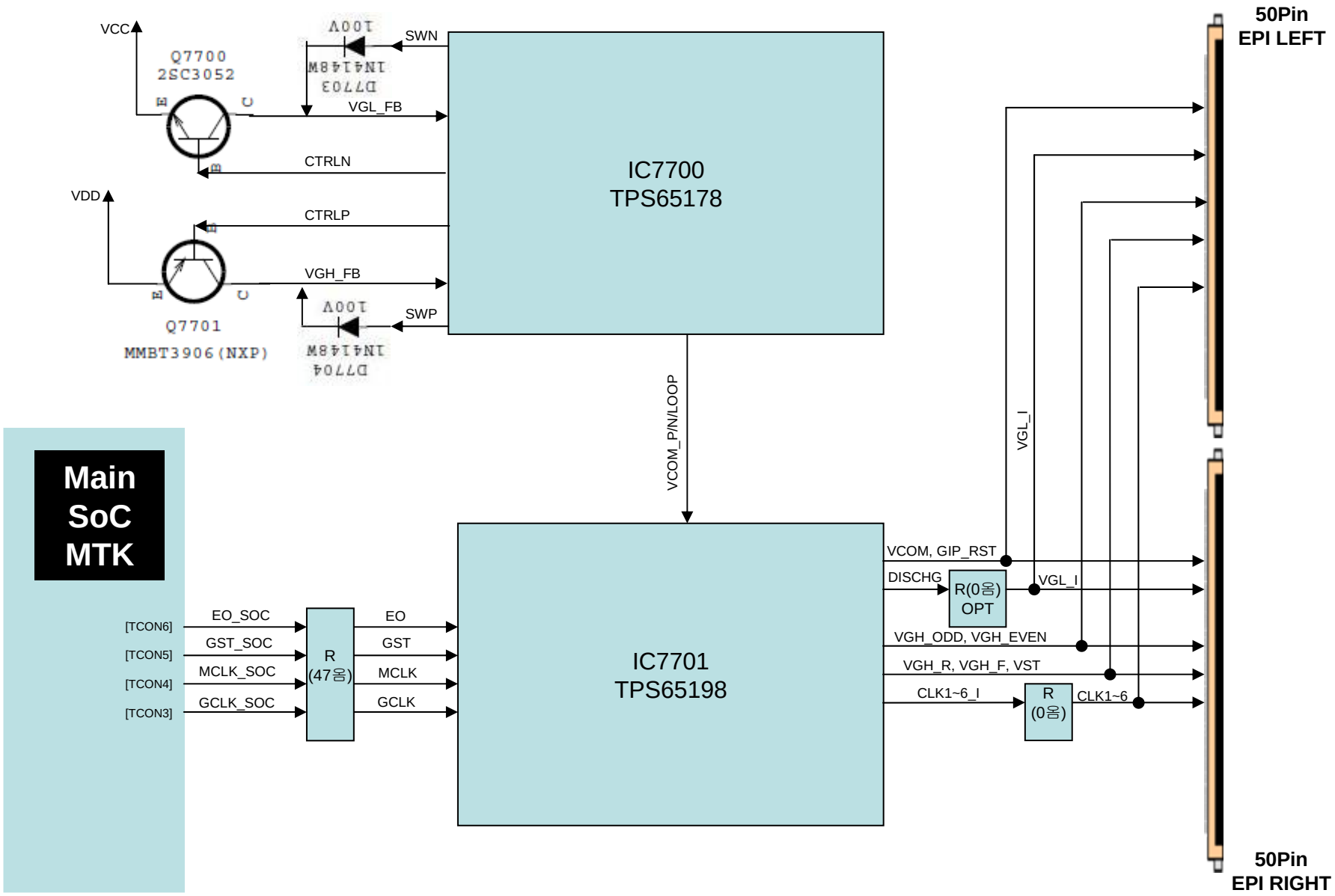
GP4 Backend block diagram (EPI & T-con)



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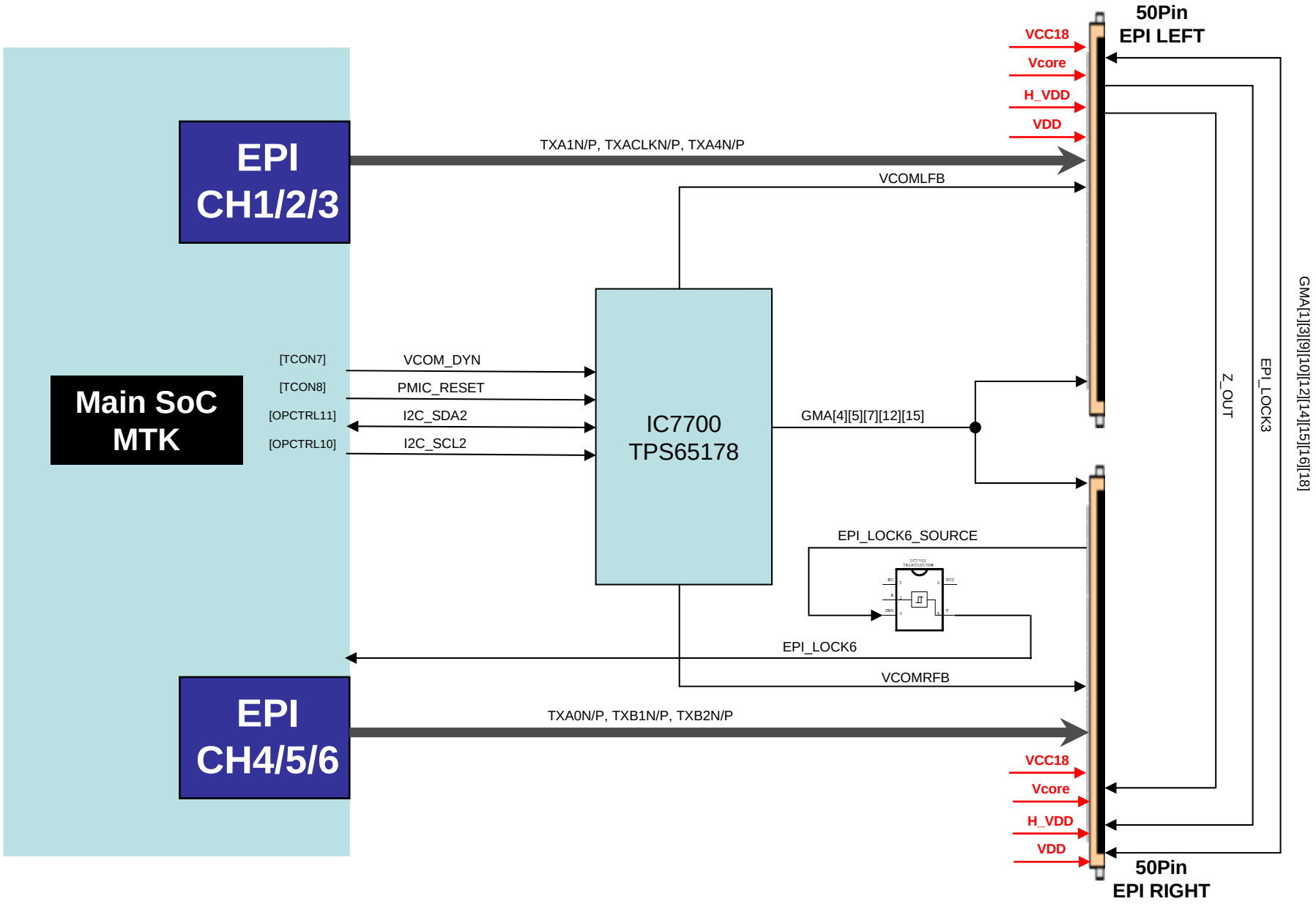
GP4 Backend block diagram (EPI & T-Con)



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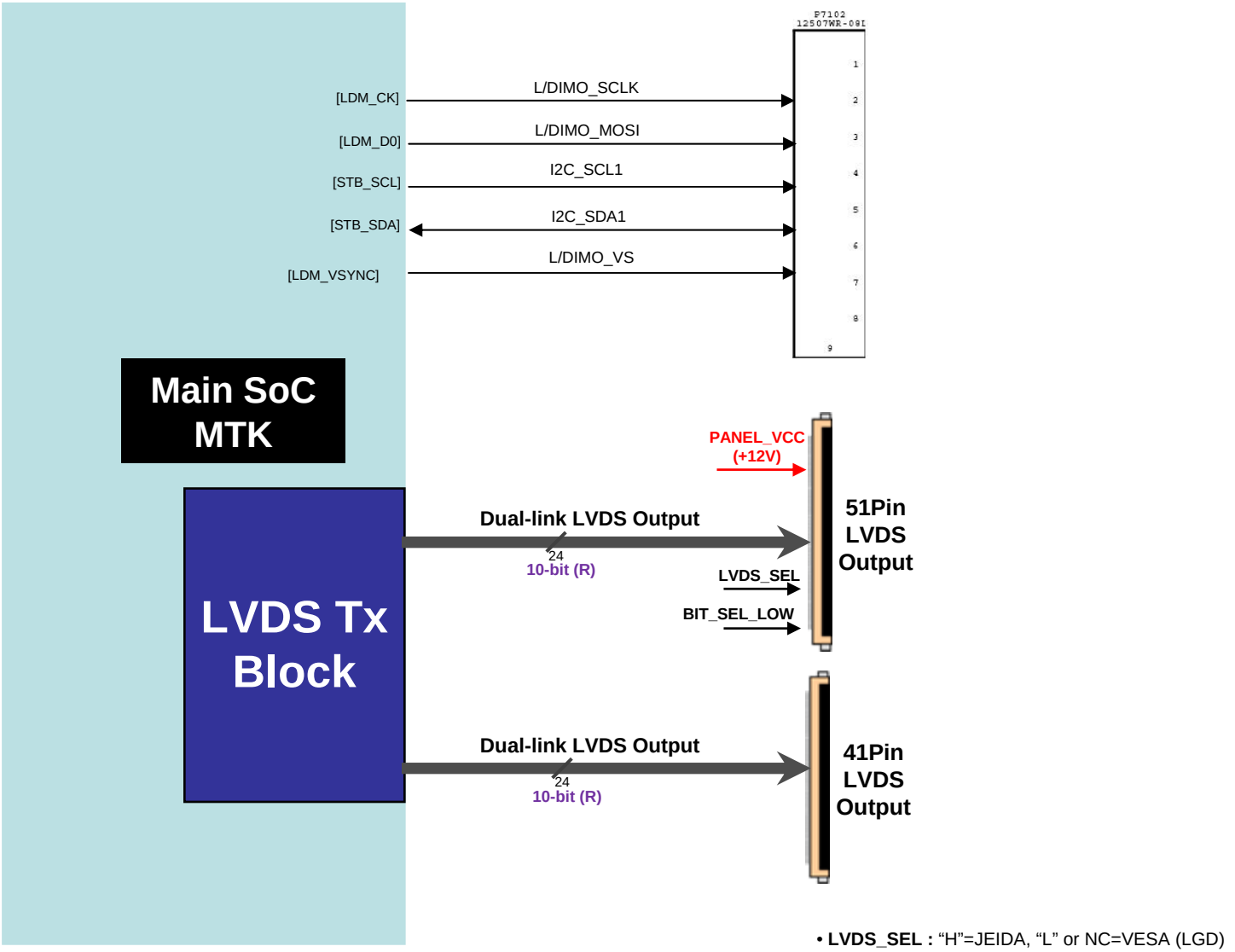
GP4 Backend block diagram (LVDS Tx & Local Dimming)



• **LVDS_SEL :** “H”=JEIDA, “L” or NC=VESA (LGD)
• **BIT_SEL** : “H” or NC = 10-bit, “L” = 8-bit

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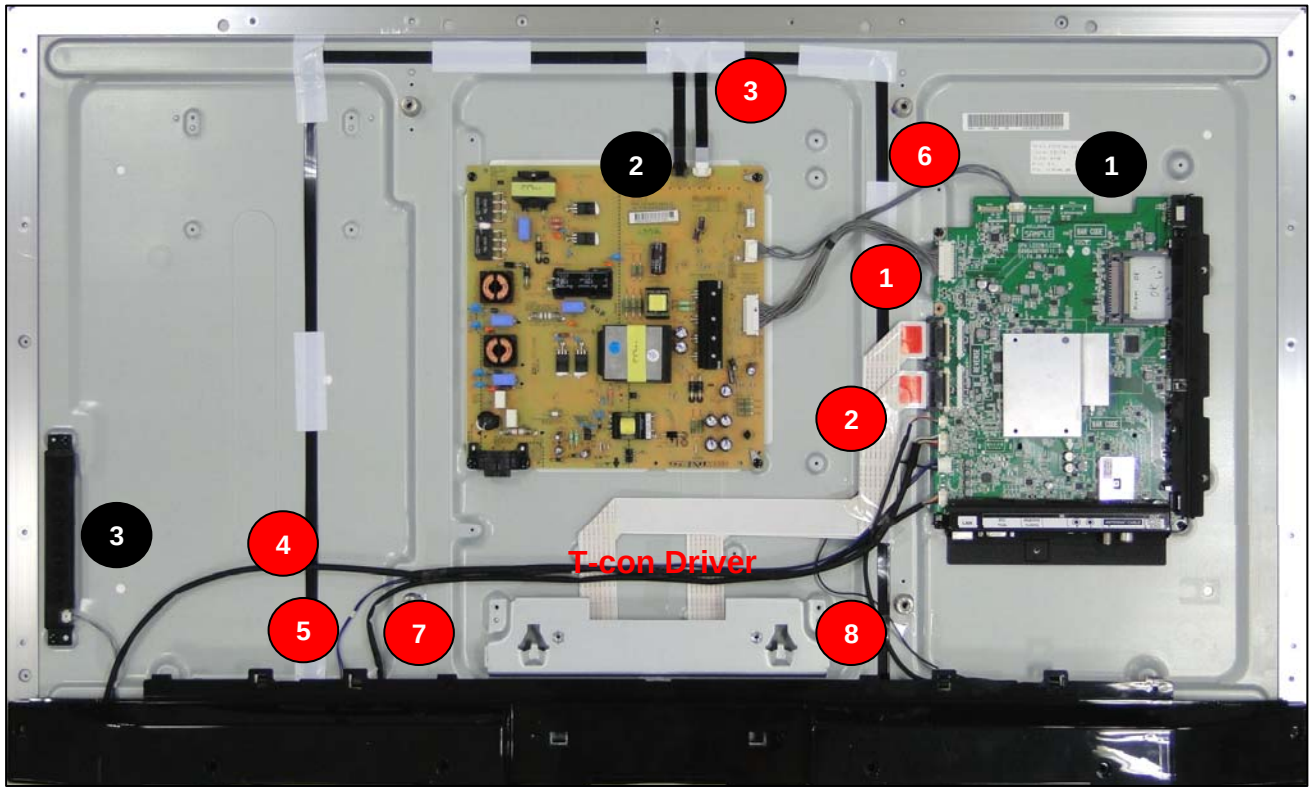
Interconnection - 1

xxLM760S-ZA



[PCBs]

1. Main PCB
2. Power Board
3. Tact key PCB
4. RF Assy
5. WIFI Assy

[Cables]

1. Main / LPB 24Pin cable
2. Main / Module EPI cable 50& 50PIN
3. LED driver / PSU
4. 10Pin (IR+Touch) Cable
5. SPK Cable
6. Local Dimming Cable
7. RF Assy Cable
8. WIFI Assy Cable

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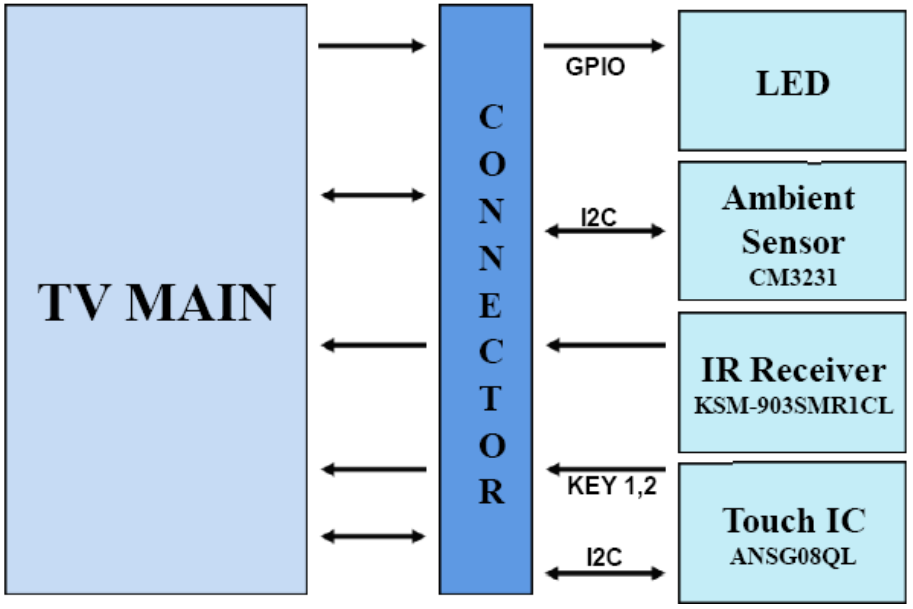
2012Y IR + Soft touch PCB Pinmap

Circuit Block Diagram



KEY1, KEY2 Voltage (Tolerance of voltage ±0.2V)

Parameter	POWER	INPUT	MENU	ENTER	VOL+	VOL-	CH+	CH-
KEY1			0.58V	0.09V	1.75V	1.18V		
KEY2	0.58V	0.09V					1.75V	1.18V

Ass'y Picture

TOP

BOTTOM

Pin Configuration

1	SCL	6	3.5V_ST
2	SDA	7	GND
3	GND	8	RED_LED
4	KEY1	9	IR
5	KEY2	10	GND

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2012Y IR + Soft Touch LED Lighting Scenario

Power LED Scenario

구분			Spec 내용	비고
Power Indicator UI			- 12Y GP4 High(L9), GP4 Mid(MTK), GP4 Low(S7LR2) → “ Power Light” UI Delete compared with 11Y(GP3 model) - 11Y Carry Over Model : 12Y same Power LED scenario process → “ Power Light “ UI Delete, The way of 11Y Soft Touch Ass’y is used. White LED Disable	-
GP4 (High/Mid/Low) Power LED Scenario	User Condition	Power On	- Stand-By condition to Red LED On : After DC ON, Red LED light Blinks twice and then Red LED is Off - Stand-By condition to Red LED Off : After DC ON, Red LED light Blinks three times and then Red LED is Off	-
		Power Off	- Without Blink, Red LED On immediately But, If the mode of Power Indicator UI is Stand-By, keep staying Red LED Off status	-
		Remote Key input	- When you put the remote Control button, Red LED Blinks once	-
		Warm Stand-by	- Red LED On stays and In the case of Set On, Red LED turns Off → Including DVR Ready model, Japanese model	Same as the 11Y
		3D mode	- Red LED Off (Power On condition is identical)	Same as the 11Y
	Factory Condition	Factory Default Mode (In-Stop)	- 12Y LED Model : Stand-By On (Red LED On) - 12Y CCFL Model : Stand-By On (Red LED On) - 11Y Carry Over Model (CS5XX/CM5XX) : Stand-By On (Red LED On) - After In-Stop, Red LED On is processed and after In-Stop, Red LED turns on within 3 sec	-
		Power Only Mode	- In the case of Power Only On, Red LED turns Off - In the case of DC Off, Red LED turns On	-

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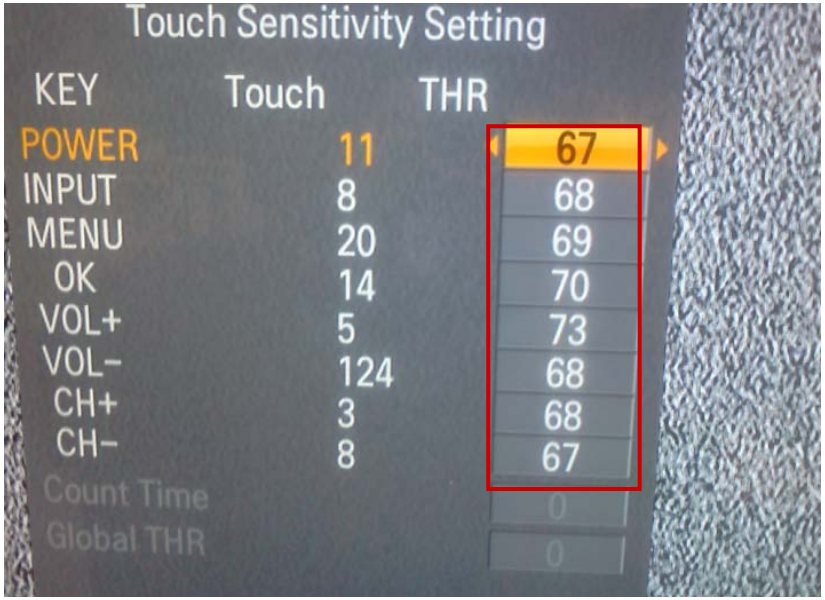
Introductions of GP4 Sensor (Touch IC)

Manual of Touch Sensitivity



1. Verify the number of THR at first.

2. Once you correctly touch Touch button for more than 1 sec, you can see a Touch data while you keep touching the button.

3. Keep in mind that you can only read the Touch data during touch status.

4. It doesn't matter that Touch data gets low value after taking off your finger.

Touch Key Threshold Level (Ta = 25ºC)

Parameter	POWER	INPUT	MENU	ENTER	VOL+	VOL-	CH+	CH-
Sensitivity	67	68	69	70	73	68	68	71

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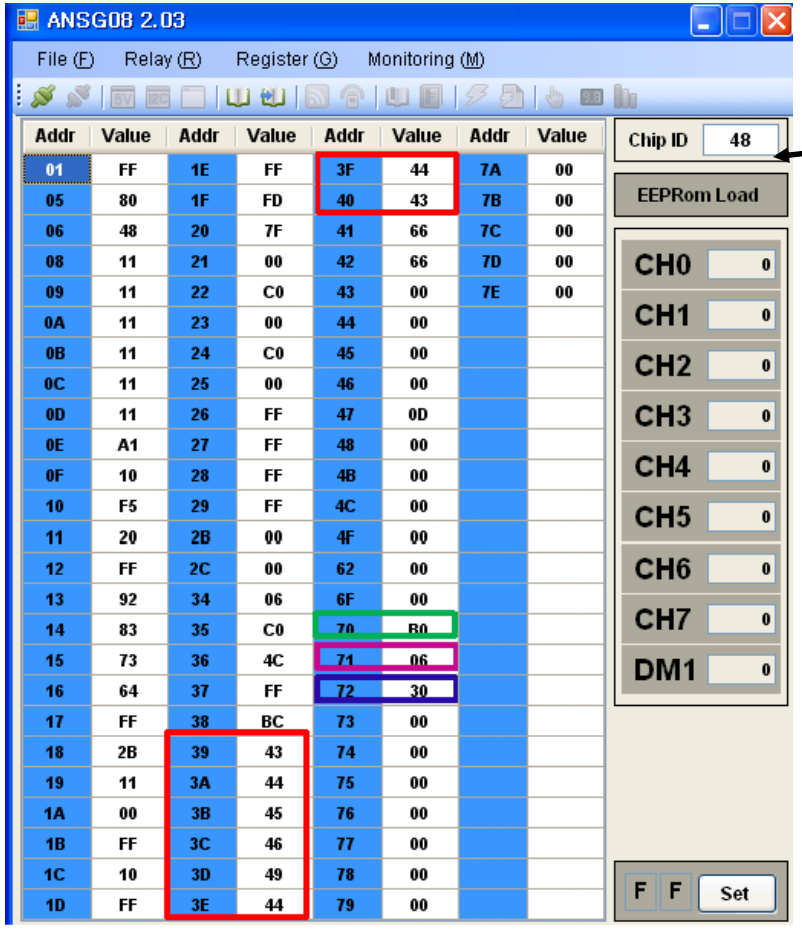
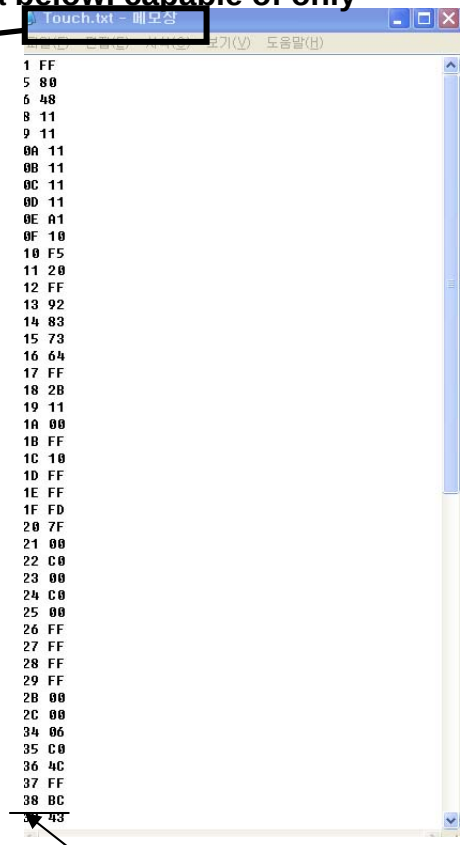
Touch EEPROM Register change with USB port



Addr	Value	Addr	Value	Addr	Value	Addr	Value
01	FF	1E	FF	3F	44	7A	00
05	80	1F	FD	40	43	7B	00
06	48	20	7F	41	66	7C	00
08	11	21	00	42	66	7D	00
09	11	22	C0	43	00	7E	00
0A	11	23	00	44	00		
0B	11	24	C0	45	00		
0C	11	25	00	46	00		
0D	11	26	FF	47	0D		
0E	A1	27	FF	48	00		
0F	10	28	FF	4B	00		
10	F5	29	FF	4C	00		
11	20	2B	00	4F	00		
12	FF	2C	00	62	00		
13	92	34	06	6F	00		
14	83	35	C0	70	B0		
15	73	36	4C	71	06		
16	64	37	FF	72	30		
17	FF	38	BC	73	00		
18	2B	39	43	74	00		
19	11	3A	44	75	00		
1A	00	3B	45	76	00		
1B	FF	3C	46	77	00		
1C	10	3D	49	78	00		
1D	FF	3E	44	79	00		

1. Write all of the address, value (Hex) as a below, capable of only Touch.txt file based on the left picture



2. Make the file [Filename : 'Touch.txt'] and move it to USB (The outermost area, Don't move it to any folder)

3. Connect USB to TV and press button 'ADJ menu' and then choose the 'touch sensitivity setting'

4. Press button 'SIMPLINK (Simply Link key)' and then you can see the OK Pop up.

5. After that, you check it the IR LED version on In-start menu and verify it that the number of version is changed to what you want.

Addr Value

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Introductions of 12Y RF ass'y + Magic Remote control

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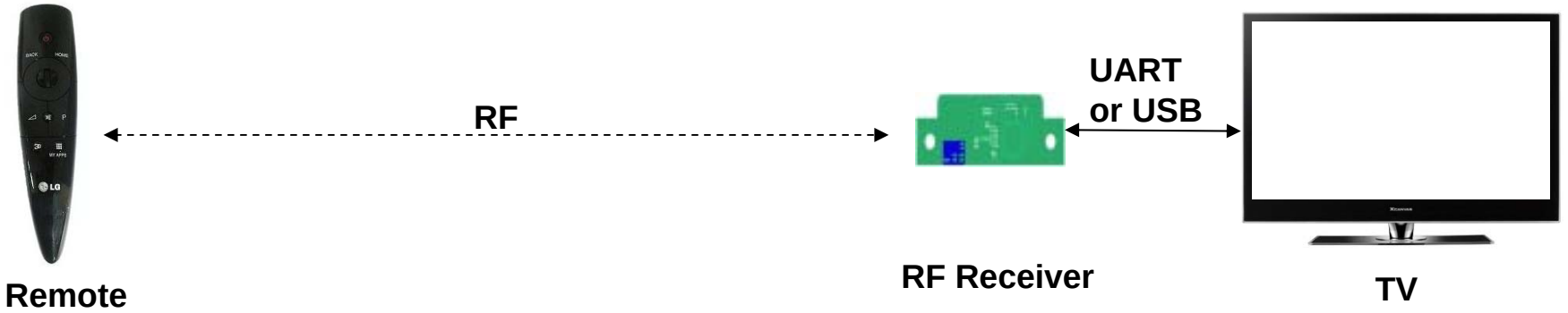
1. System



❖ ***Pairing Information Transmission (Send to TV after Paired)***

- Static Calibration Data (Bypass only)
- Remote FW ver. (Save also in Receiver)
- BD_ADDR (Save also in Receiver)

- ***Pairing Information Transmission Sequence***
  - When it is paired, the remote sends packets(pairing success, F/W version, BD_ADDR) to the receiver.
  - The receiver sends the pairing success packet to TV directly.
  - F/W version and BD_ADDR packets are just saved on the receiver.
  - The receiver sends F/W version or BD_ADDR packet to TV when it is required.

❖ ***Motion Data Transmission***

- Period : 7.5msec
- Motion Data : gyro, accelerometer

❖ ***Voice Data Transmission***

- Period : 10msec
- Voice sampling : 16khz 16bit

→ **See "6-2. Packets" on page 8.**

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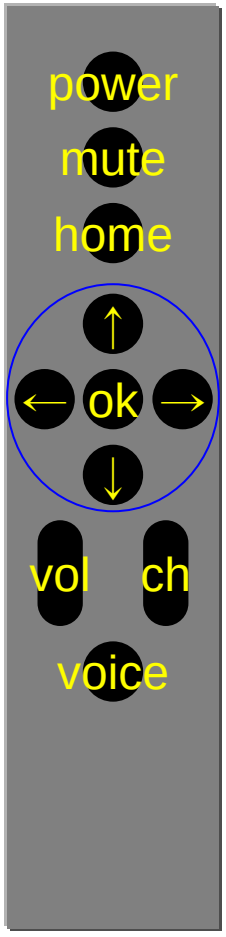
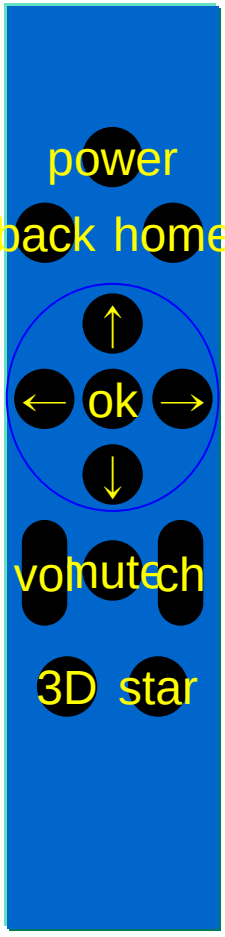
2. Remote Buttons (M3 vs. M4)



M3 Remote



M4 Remote

BUTTON		RF Unpaired IR_CODE	RF Paired RF_CODE	IR continuous repeat	ETC.
Phsical Buttons	POWER	0x08	0x08	**Y**	IR only
	BACK	0x28	0x8028	**Y**	
	HOME	0x7C	0x807C	**Y**	
	←	0x07	0x8007	**Y**	
	→	0x06	0x8006	**Y**	
	↑	0x40	0x8040	**Y**	
	↓	0x41	0x8041	**Y**	
	OK	0x75	0x8044	**Y**	
	CH +	0x00	0x8000	**Y**	
	CH -	0x01	0x8001	**Y**	
	VOL +	0x02	0x8002	**Y**	
	VOL -	0x03	0x8003	**Y**	
	MUTE	0x09	0x8009	**Y**	.
	3D_Mode	0xDC	0x80DC	**Y**	
	MyAPPS	0x42	0x8042	**Y**	
	VOICE		0x800A	**Y**	= VOICE_START
Logical Buttons	AUTO_WAKEUP	X	0x800C		
	VOICE_START	X	0x800A		
	VOICE_STOP	X	0x800D		
	POINT_START	X	0x803E		
	POINT_STOP	X	0x803F		

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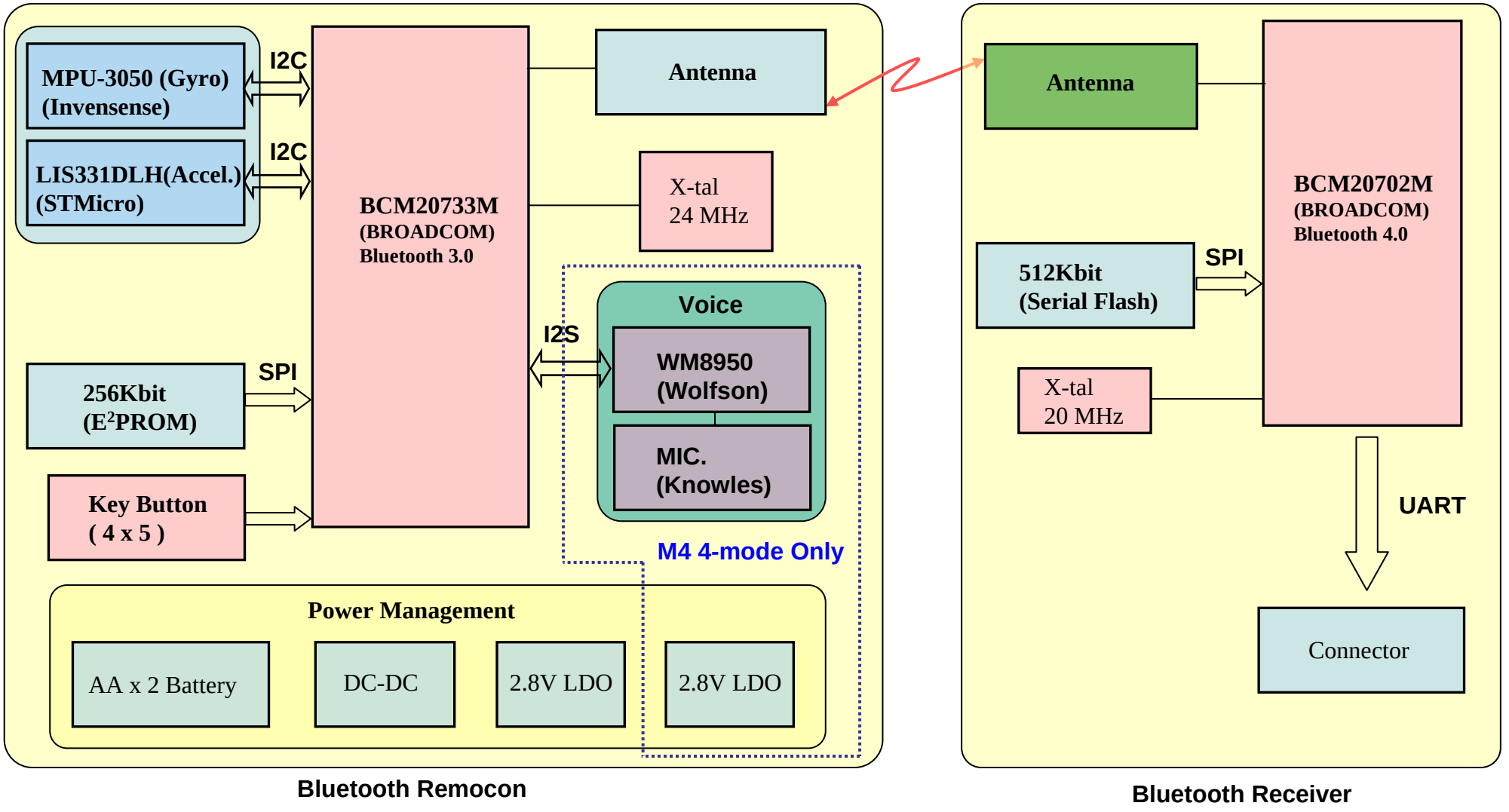
3. M4 Block Diagram



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4. Function list

주요 Item			IC	Manufacturer	Function
Remocon	Voice	Voice Codec	WM8950	Wolfson	16KHz Sampling of Audio data
		MEMS Mic.	SPU0414HR5H	Knowles	Sensing Voice
	Motion Sensor	Gyro Sensor	ITG3050	Invensense	Sensing angular velocity of X, Y, Z-axis
		Accelerometer	MMA8452	Stmicro	Sensing device tilt (Pitch & Roll angle)
	RF + Micom	RF Antenna	SDBTPTR3015	Partron	Wireless communication
		X-tal	24MHz	Partron	
		RF + Micom	BCM20733	Broadcom	
	DC-DC Converter		TPS61097	TI	Battery Boost up Regulator
	LDO1		uPI7716	uPI	RF, Gyro, Accelerometer Power Supply
	LDO2		uPI7716	uPI	Audio Codec, Mic. Power Supply

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5. RF Pairing / Un-pairing Method

	Method	Description
RF Pairing	❖ Method1 – If unpaired, just press "OK" button. – If paired, press "OK" button after unpairing. ❖ Method 2 (Repairing) – Press “BACK" button for 5 sec.	• When do pairing, the remote should make pairing request IR signal(0x29) to TV. • When TV receive the IR signal, it should send "pairing request packet" to the RF receiver. • After pairing success, the remote should blink LED for some time and TV send "pairing success packet" back to TV. • When remote try to unpairing, it doesn’t care about state of receiver(stand alone).
RF Unpairing	Press “HOME" button and “BACK" button at the same time for 5 sec.	• When remote try to unpairing, it doesn’t care about state of receiver(stand alone). • After unpairing, all pairing information should be erased. • After unpairing, LED should be blinked for 3sec. • The remote just becomes to IR mode.

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Introductions of 12Y WIFI built in ass'y

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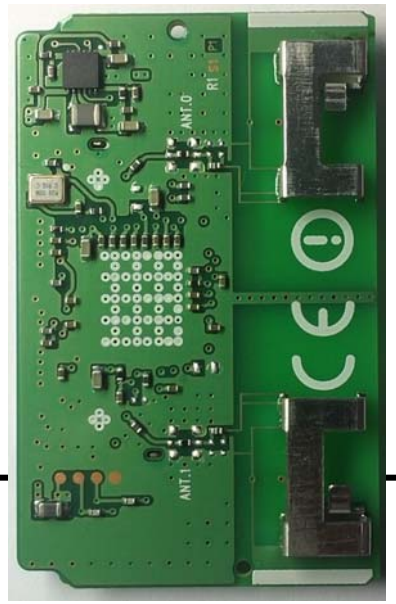
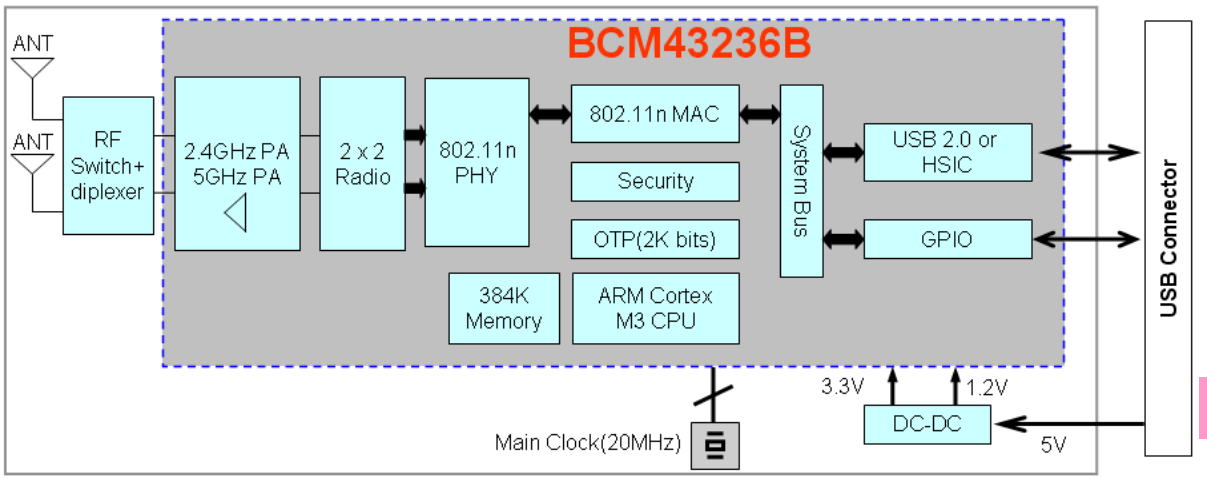
WIFI Built in ass'y feature(LGIT)

WIFI built in feature



- Pin map

PIN	USB interface
1	5V
2	DM
3	DP
4	GND



- Block diagram

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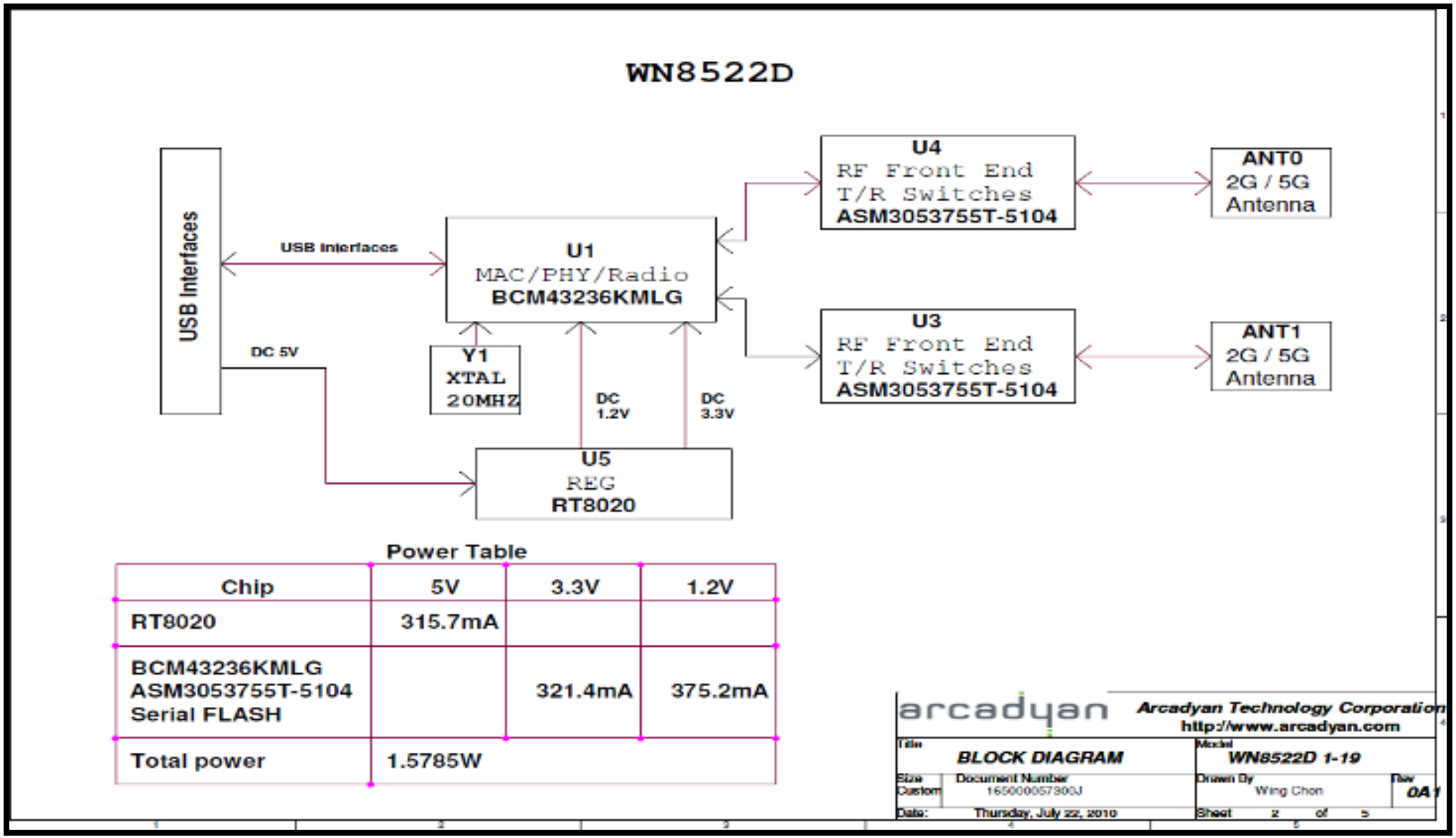
WIFI Built in Block-diagram(Arcadyan)



Power Table

Chip	5V	3.3V	1.2V
RT8020	315.7mA		
BCM43236KMLG ASM3053755T-5104 Serial FLASH		321.4mA	375.2mA
Total power	1.5785W		

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WIFI Built in ass'y Specification

- Frequency Band:
  - Draft 802.11n Radio: 2.4 GHz
  - 802.11g Radio: 2.4 GHz
  - 802.11b Radio: 2.4 GHz

USA – FCC	2412~2462MHz (Ch1~Ch11)
Canada – IC	2412~2462MHz (Ch1~Ch11)
Europe – ETSI	2412~2472MHz (Ch1~Ch13)
Japan – STD-T66/STD-33	2412~2484MHz (Ch1~Ch14)

802.11a Radio : 5 GHz

5.150~5.250GHz

5.725~5.850GHz

- Operating Channels:
  IEEE 802.11b/g/n compliant:
  - 11 channels (US, Canada)
  - 13 channels (ETSI)
  - 14 channels (Japan)

- Transmit Power and Sensitivity:

TX Output Power:(Typical) (Meet emission standard)

11b	17	+/- 2 dBm
11g	14	+/- 2 dBm@54Mbps (Each chain)
11n	13	+/- 2 dBm (Each chain)

Rx Sensitivity:(Typical)

- -69dBm at HT20 m7 2.4GHz
- -87dBm at HT20 m0 2.4GHz
- -69dBm at HT20 m7 5.0GHz
- -87dBm at HT20 m0 5.0GHz

- Modulation
  - DBPSK @1Mbps
  - DQPSK@2Mbp
  - CCK@5.5/11Mbps
  - BPSK@6/9 Mbps
  - QPSK@12/18Mbps
  - 16-QAM@24Mbps
  - 64-QAM@48/54Mpb and above

- Current consumption(5V DC):
  Full load: 430mA
- Operating Temperature: 0 ~ 60 °C ambient
- Storage Temperature: -20 ~ 60 °C ambient
- Humidity: under 85% and must be non-condensing

- Regulation and certification compliance available:
  - CE
  - FCC
  - WiFi

  - WPS

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12Y Widevine & HDCP 2.0 & NETFLX

1. Widevine?
2. HDCP 2.0 & NETFLIX?
3. DTCP?
4. Changed BOM

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1. Widevine?

[Widevine]

Widevine is the Solution(Library) offering Adaptive Streaming and DRM.
In BBTV, when special CP do service, this module is required key.
Currently CP which is requested to widevine, is typically Australian Bigpond Live and North American CinemaNow.
Furthermore, because the future will be the spread of CP, widevine key download for the global model should be applied to production.
(Because operation unique key should be downloaded for Widevine , Widevine key dowmload by NSU is impossible.)

[Widevine Key]
Widevine Key is unique data stored TV for using Widevine.

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2. HDCP 2.0 & NETFLIX?

❑ HDCP

✓ High-bandwidth Digital Content Protection

✓ Protect high-value digital motion pictures, television programs and audio against unauthorized interception and copying between a digital set top box or digital video recorder and a digital TV or PC.

✓ Specification developed by Intel Corporation to protect digital entertainment across the DVI/HDMI interface.

❑ Why HDCP2.0?

✓ HDCP revision 2.0 supports a broader range of wired and **wireless** interfaces.

❑ Netflix

✓ the services maintain a huge selection of movies and latest releases and offer DVD rentals via mail & online streaming.

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3. DTCP?

[DTCP]

The Digital Transmission Content Protection Specification defines a cryptogrphic protocol for protecting audio/video entertainment content from unauthorized copying, intercepting, and tampering as it traverses digital transmission mechanisms such as a high-performance serial bus that conforms to the IEEE 1394-1995 standard. Only legitimate entertainment content delivered to a source device via another approved copy protection system (such as the DVD Content Scrambling System) will be protected by this protection system.

[Three cryptographic Keys]

• Authentication Key which is formed as a result of authentication and used to protect the exchange keys.

•Exchage Key which is used to set up and protect content streams.

•Content Key which is used to encrpt the content being exchanged.

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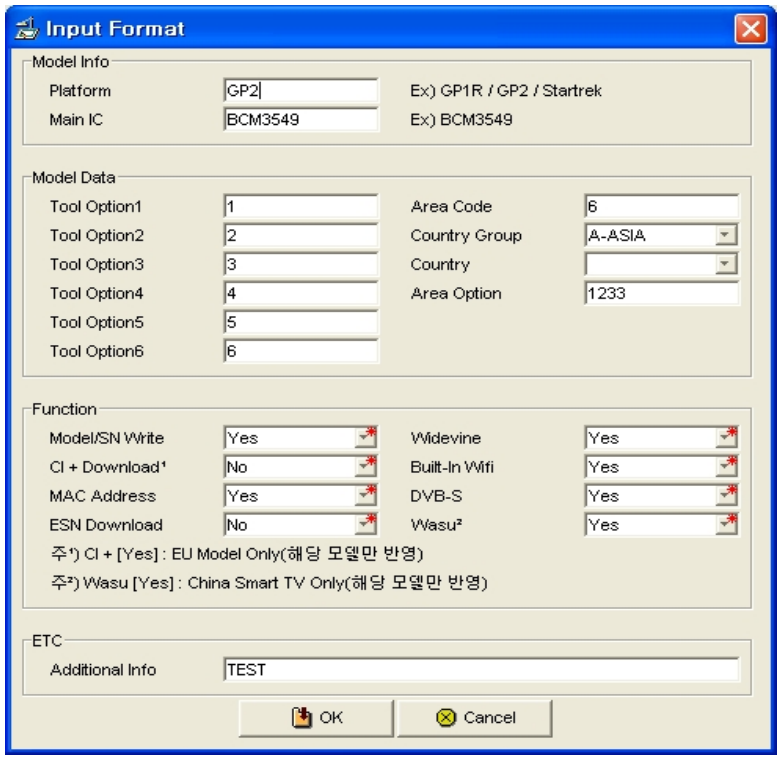
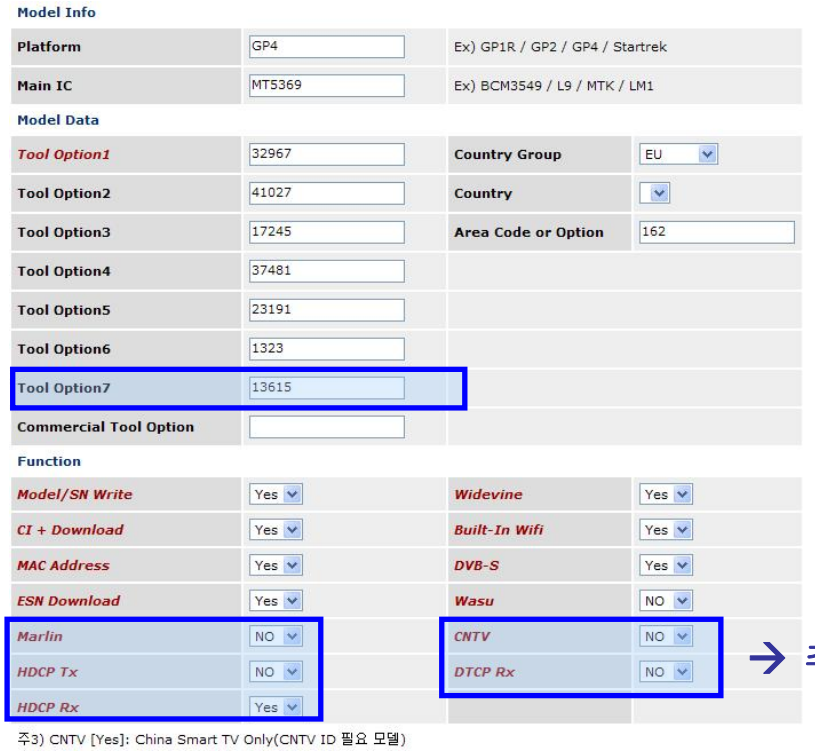
4. Changed BOM

As-Was



Current



→ 추가

❍ Add Item

1.Marlin (Yes/No)
2.CNTV (Yes/No)
3.HDCP Tx (Yes/No)
4.DTCP Rx (Yes/No)
5.HDCP Rx (Yes/No)
주3) CNTV [Yes] : China Smart TV Only

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4. Changed BOM

	Tool Option	bits	Range	Remark	Guide
Tool OPT7 (Automation Checkup)	Mac_AP Key	1	0/1 0:off 1:on	Automation checkup	Check whether or not key write MAC-AP:Global ESN_AP:Global(Except China) CI_AP:EU/CIS WIDEVINE_AP:Global MARLIN_AP:Japan only
	ESN_AP Key	1	0/1 0:off 1:on	Automation checkup for Netflix Service	
	CI_AP Key	1	0/1 0:off 1:on	Automation checkup	
	WIDEVINE_AP Key	1	0/1 0:off 1:on	Automation checkup for CP or 3D Zone Steaming Service	
	Marlin_AP key	1	0/1 0:off 1:on	Automation checkup	
	EDID_TPE	2	0:PCM 1:AC3 2:Rewerved		
	LED Current	2	0/1/2/3/4 0: 85mA 1: 100mA 2: 105mA 3: 130mA	Setting PWM Duty each Module	Setting each model's Spec
	LED Bar Type(LCD Only) Pen Touch Tv(PDP Only)	2	LCD : V_12B,V_6B,H_12B,H_6B PDP : Off,Ready, Buitln,NULL	LED Bar (LCD Only) Pen touch (PDP Only)	In case of LPB(Tool OPT4/Power Type), This tool is valid.
	DiiVa	1	0/1		In case of LPB(Tool OPT4/Power Type), This tool is valid.
	XvYcc	1	0:not Support 1:Support	Check whether or not support of Module Color Gamut XvYCC	China : ON, Global(Except china) :OFF
	MRCU	1	0:not Support 1:Support	Check whether or not support of Voice recognition function	Setting each Module
	Gesture	1	0:not Support 1:Support	Check whether or not support of gesture recognition function	
	PWM_Freq	1	0:50_60Hz 1:PWM_DB	Setting each Module	L9 : ON, MTK : Off
	Sum of bits	16	Full Assign		

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Contents of LCD TV Standard Repair Process

No.	Error symptom (High category)	Error symptom (Mid category)	Page	Remarks
1	A. Video error	No video/Normal audio	1	
2		No video/No audio	2	
3		Video error, video lag/stop, fail tunning	3, 4	
4		Color error	5	
5		Vertical/Horizontal bar, residual image, light spot, external device color error	6	
6	B. Power error	No power	7	
7		Off when on, off while viewing, power auto on/off	8	
8	C. Audio error	No audio/Normal video	9	
9		Wrecked audio/discontinuation/noise	10	
10	D. Function error	No response in remote controller, key error, recording error, memory error	11	
11		External device recognition error	12	
12	E. Noise	Circuit noise, mechanical noise	13	
13	F. Exterior error	Exterior defect	14	

First of all, Check whether there is SVC Bulletin in GCSC System for these model.

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Contents of LCD TV Standard Repair Process Detail Technical Manual

No.	Error symptom	Content	Page	Remarks
1	A. Video error_ No video/Normal audio	Check LCD back light with naked eye	A1	
2		LED driver B+ 24V measuring method	A2	
3		Check White Balance value	A3	
4		Power Board voltage measuring method	A4	
6	A. Video error_ No video/Video lag/stop	TUNER input signal strength checking method	A6	
7		LCD-TV Version checking method	A7	
9	A. Video error_Color error	LCD TV connection diagram	A8	
10		Tuner Checking Part	A9	
11		Check Link Cable (LVDS) reconnection condition	A10 A11	A10 : 32/37/42/47/55 A11 : 32 AUO
12		Adjustment Test pattern - ADJ Key	A12	
13	A. Video error_Vertical/Horizontal bar, residual image, light spot	LCD TV connection diagram	A8	
14		Check Link Cable (LVDS) reconnection condition	A10 A11	A10 : 32/37/42/47/55 A11 : 32 AUO
15		Adjustment Test pattern - ADJ Key	A12	
16	**<Appendix>** Defected Type caused by T-Con/ Inverter/ Module	Exchange T-Con Board (1)	A-1/5	
17		Exchange T-Con Board (2)	A-2/5	
18		Exchange LED driver Board (PSU)	A-3/5	55” : driver board Other : PS
19		Exchange Module itself (1)	A-4/5	
20		Exchange Module itself (2)	A-5/5	

Continue to the next page

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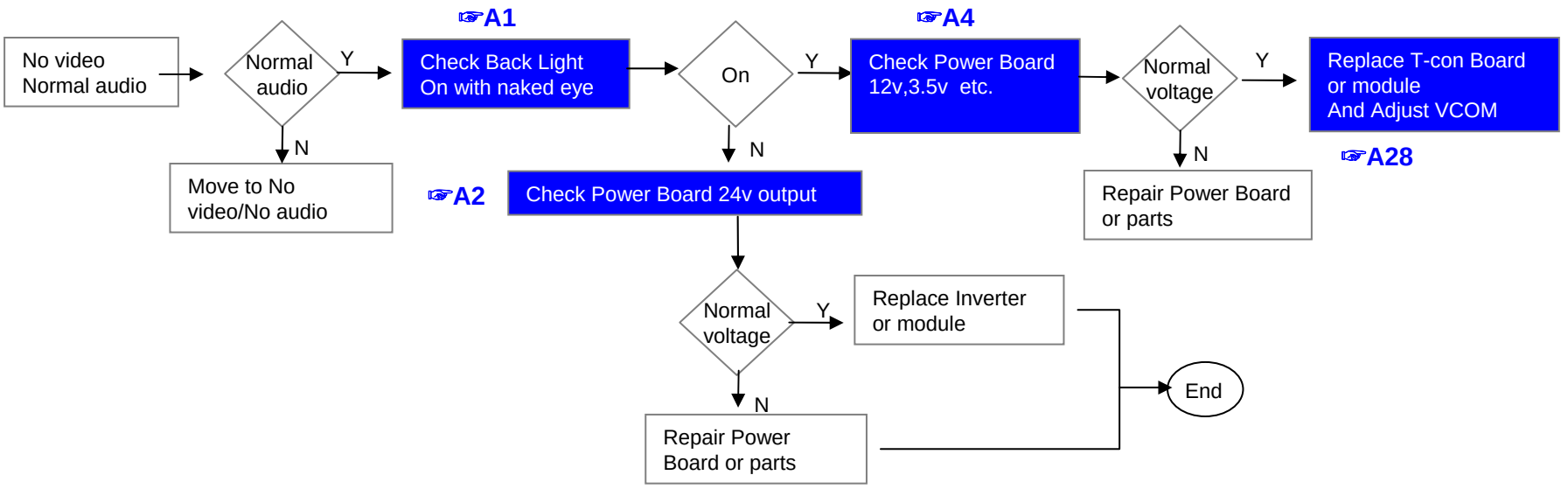
LCD TV	Error symptom	A. Video error	Established date	2010. 12 .14	
		No video/ Normal audio	Revised date		1/13

First of all, Check whether all of cables between board is inserted properly or not.
(Main B/D↔ Power B/D, LVDS Cable,Speaker Cable,IR B/D Cable,,,)



※Precaution ☞A7 & A3

Always check & record S/W Version and White Balance value before replacing the Main Board → Replace Main Board → Re-enter White Balance value

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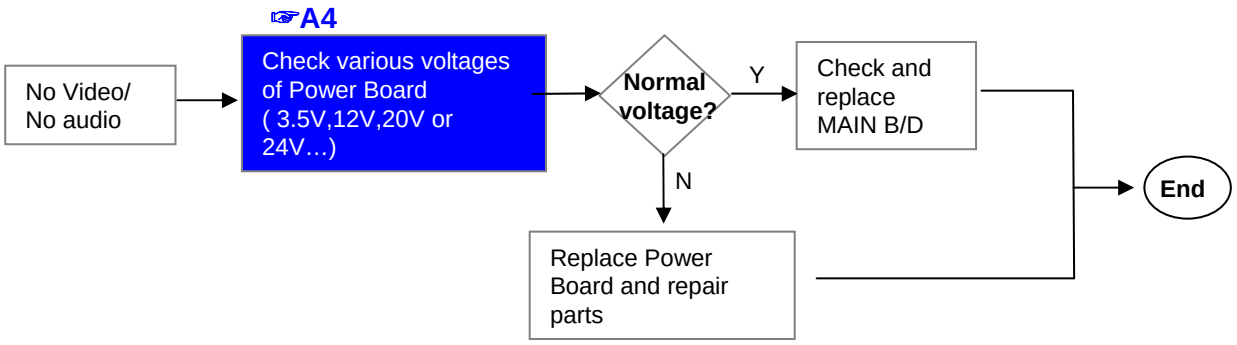
LCD TV	Error symptom	A. Video error	Established date	2010. 12 .14	
		No video/ No audio	Revised date		2/13



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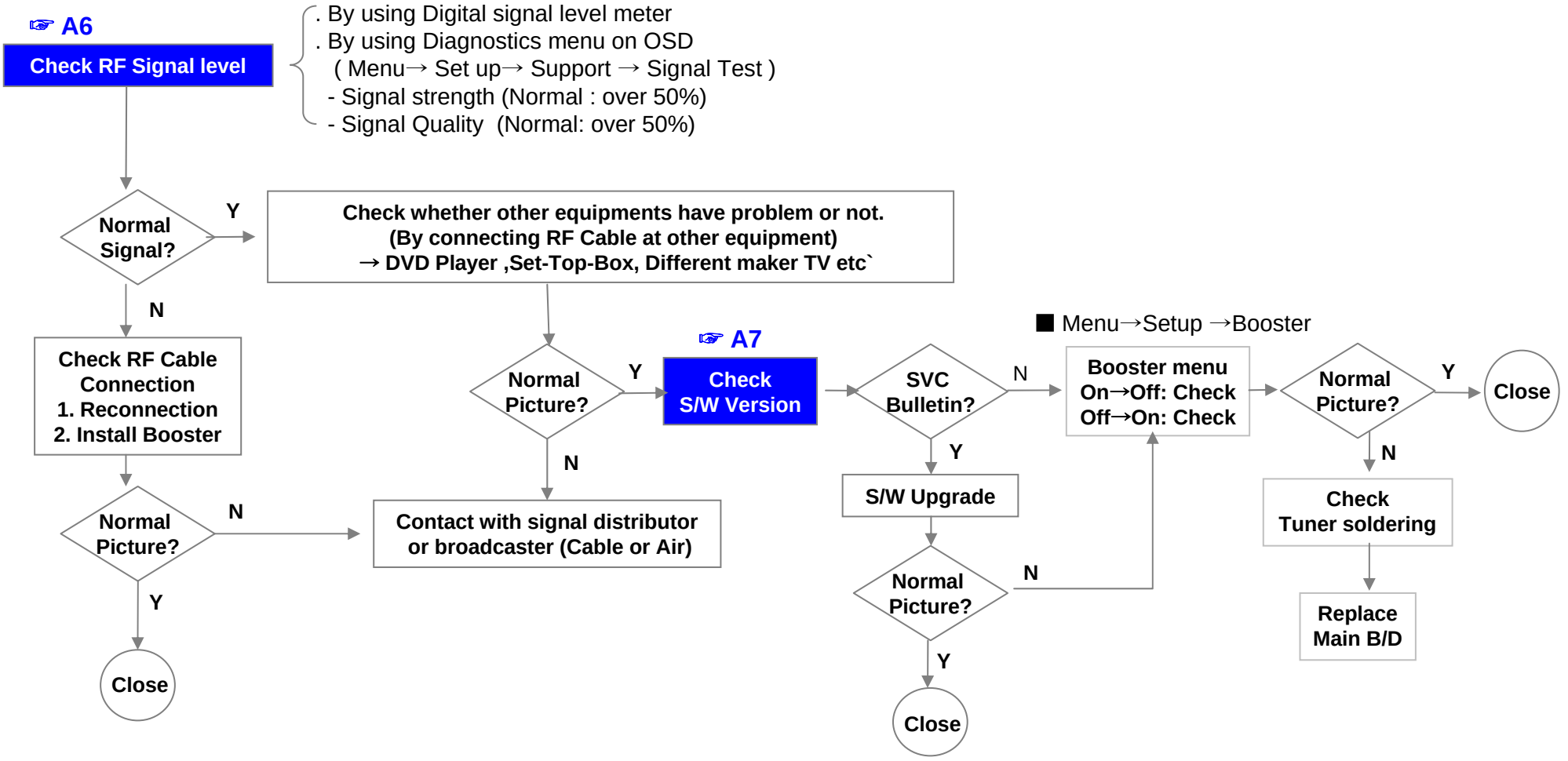
LCD TV	Error symptom	A. Picture Problem	Established date	2010. 12 .14	
		Picture broken/ Freezing	Revised date		3/13



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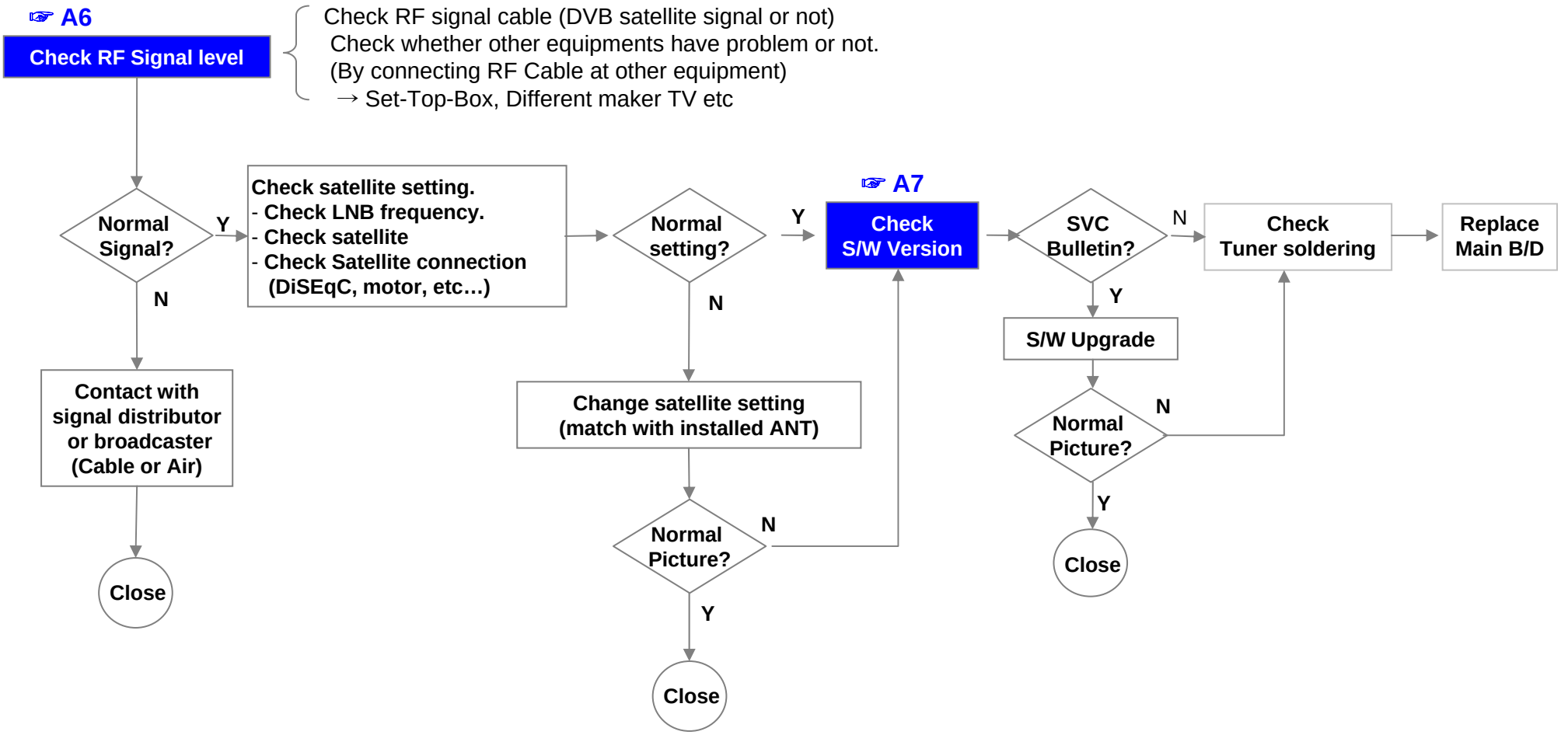
LCD TV	Error symptom	A. Picture Problem (DVB-S/S2)	Established date	2011. 01 .24	
		Tuning fail, Picture broken/ Freezing	Revised date		3/13



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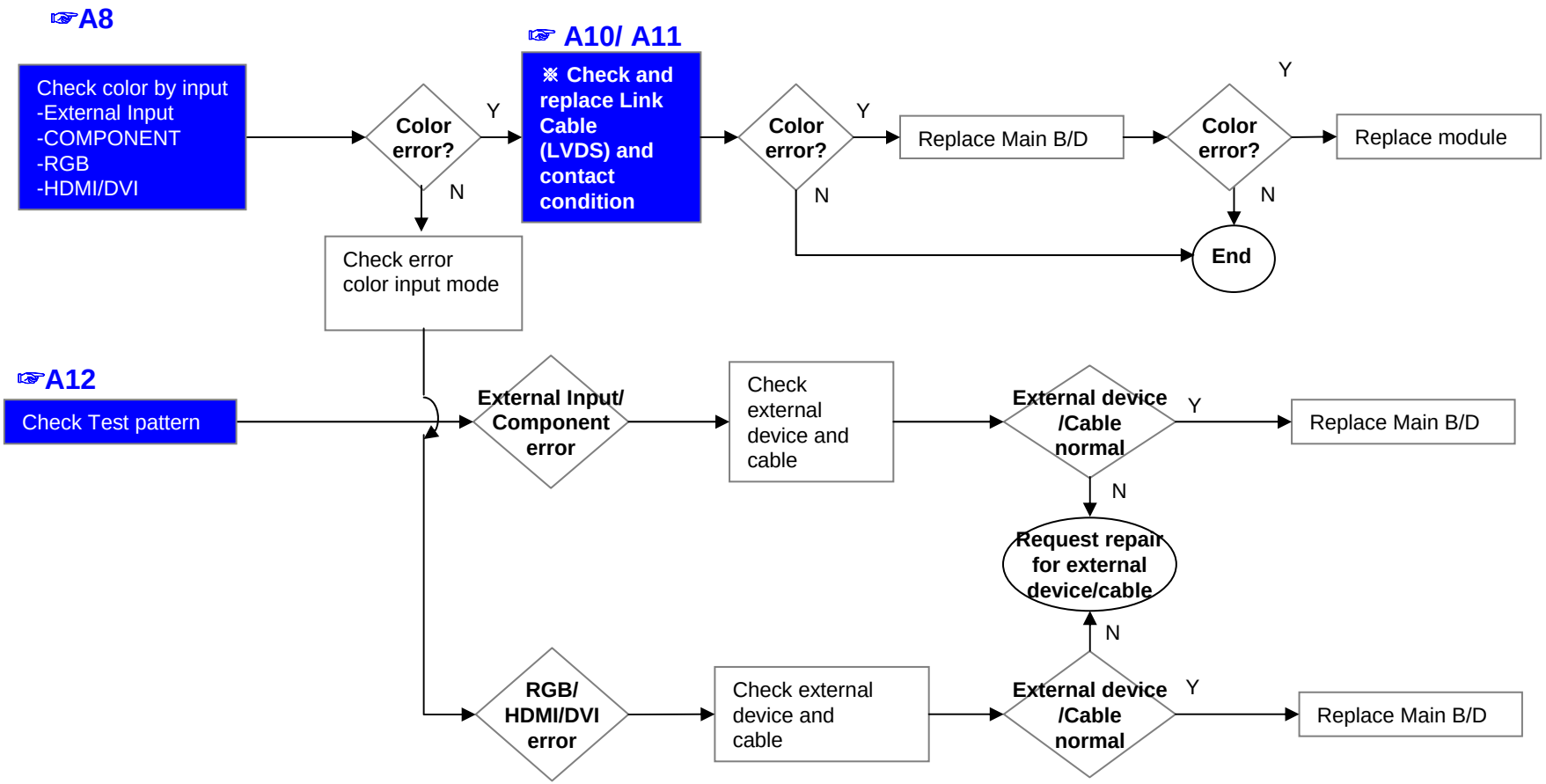
LCD TV	Error symptom	A. Video error	Established date	2010. 12 .14	
		Color error	Revised date		4/13



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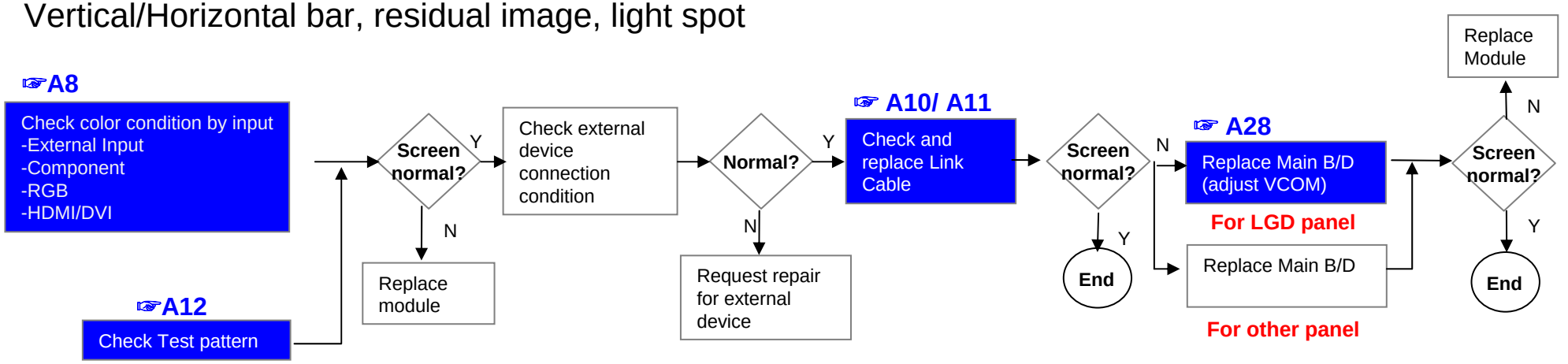
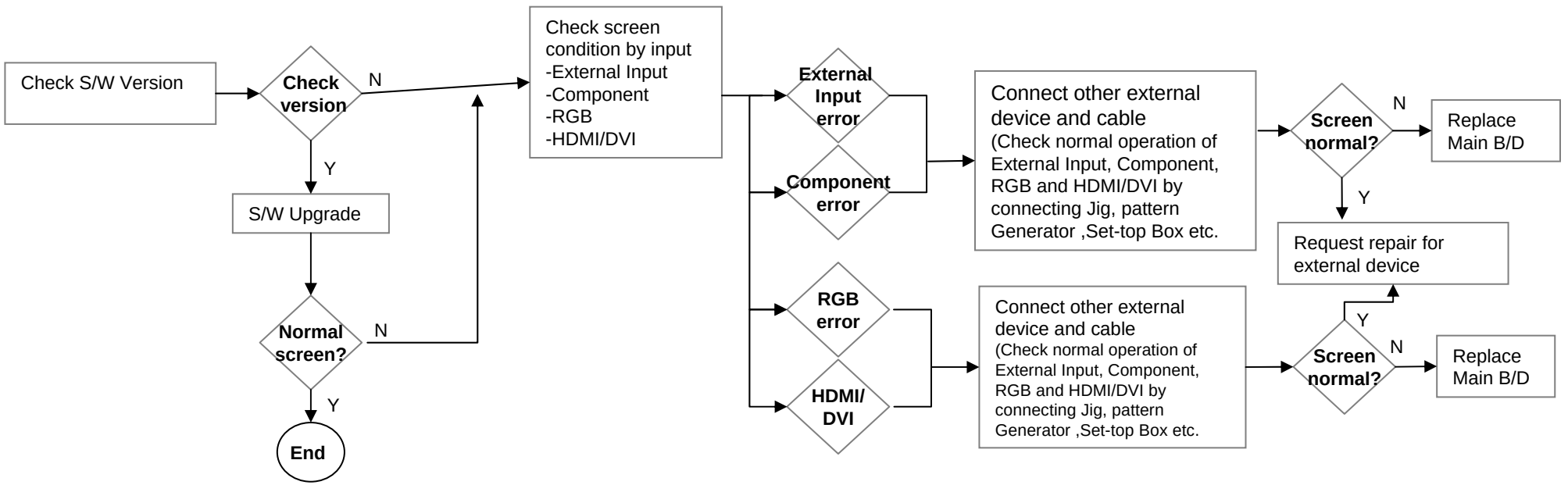
Vertical/Horizontal bar, residual image, light spot



External device screen error-Color error



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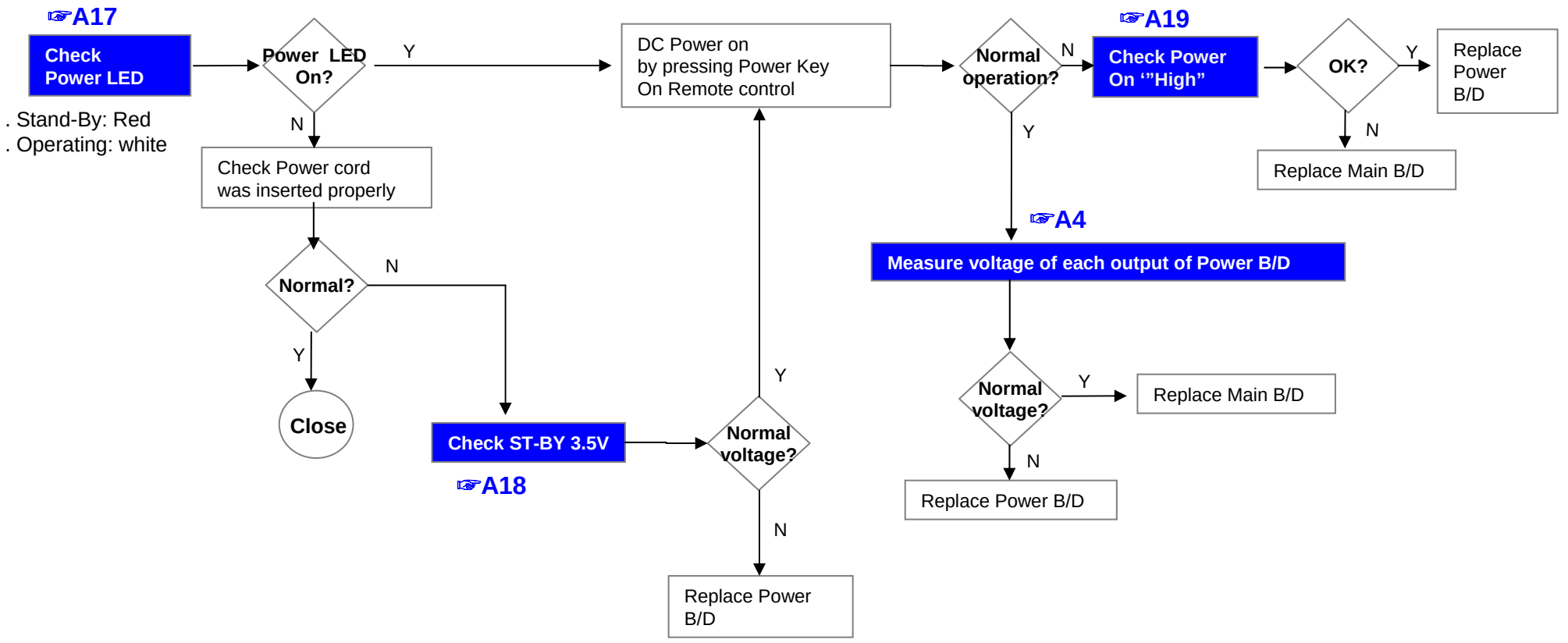
LCD TV	Error symptom	B. Power error	Established date	2010. 12 .14	
		No power	Revised date		6/13



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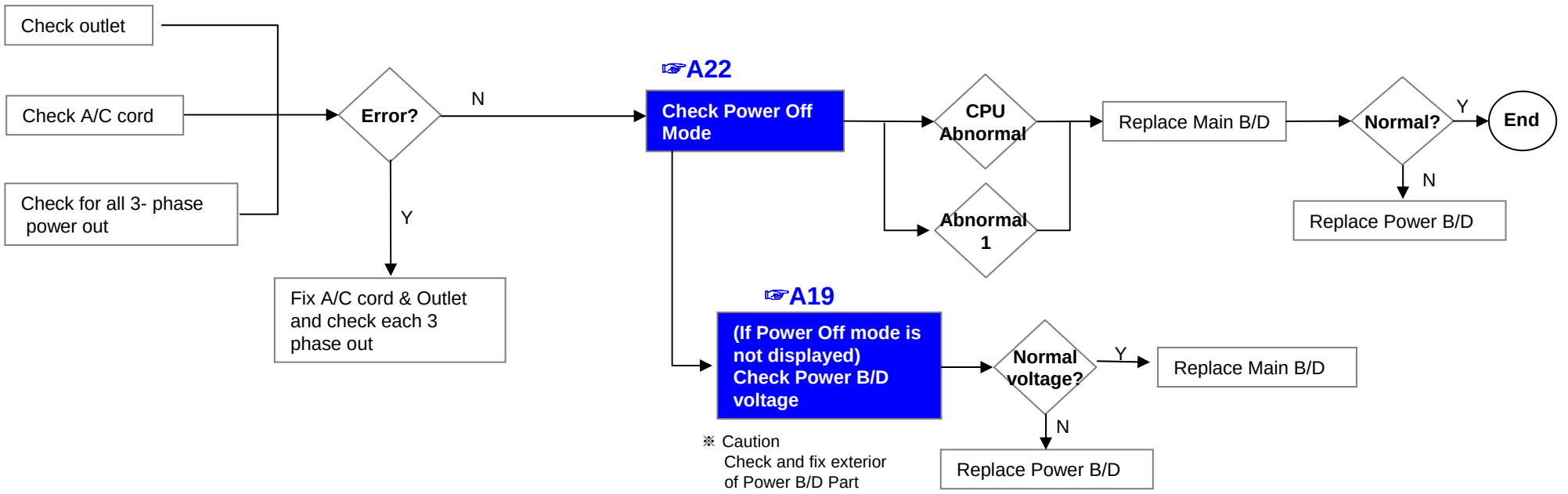
LCD TV	Error symptom	B. Power error	Established date	2010. 12 .14	
		Off when on, off while viewing, power auto on/off	Revised date		7/13



*** Please refer to the all cases which can be displayed on power off mode.**

Status	Power off List	Explanation
Normal	"POWEROFF_REMOTEKEY"	Power off by REMOTE CONTROL
	"POWEROFF_OFFTIMER"	Power off by OFF TIMER
	"POWEROFF_SLEEPTIMER"	Power off by SLEEP TIMER
	"POWEROFF_INSTOP"	Power off by INSTOP KEY
	"POWEROFF_AUTOOFF"	Power off by AUTO OFF
	"POWEROFF_ONTIMER"	Power off by ON TIMER
	"POWEROFF_RS232C"	Power off by RS232C
	"POWEROFF_RESREC"	Power off by Reservated Record
	"POWEROFF_RECEND"	Power off by End of Recording
	"POWEROFF_SWDOWN"	Power off by S/W Download
	"POWEROFF_UNKNOWN"	Power off by unknown status except listed case
Abnormal	"POWEROFF_ABNORMAL1"	Power off by abnormal status except CPU trouble
	"POWEROFF_CPUABNORMAL"	Power off by CPU Abnormal

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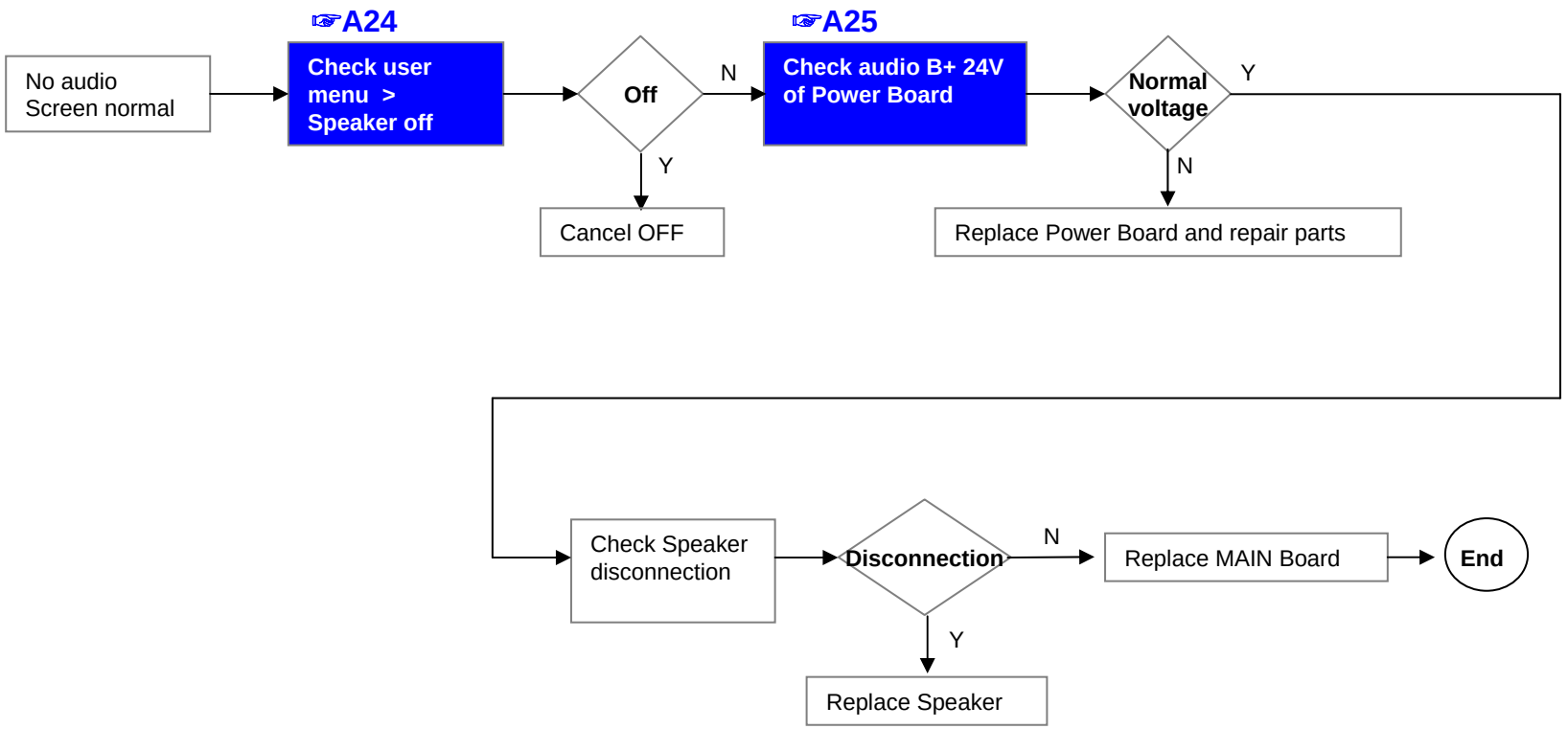
LCD TV	Error symptom	C. Audio error	Established date	2010. 12 .14	
		No audio/ Normal video	Revised date		8/13



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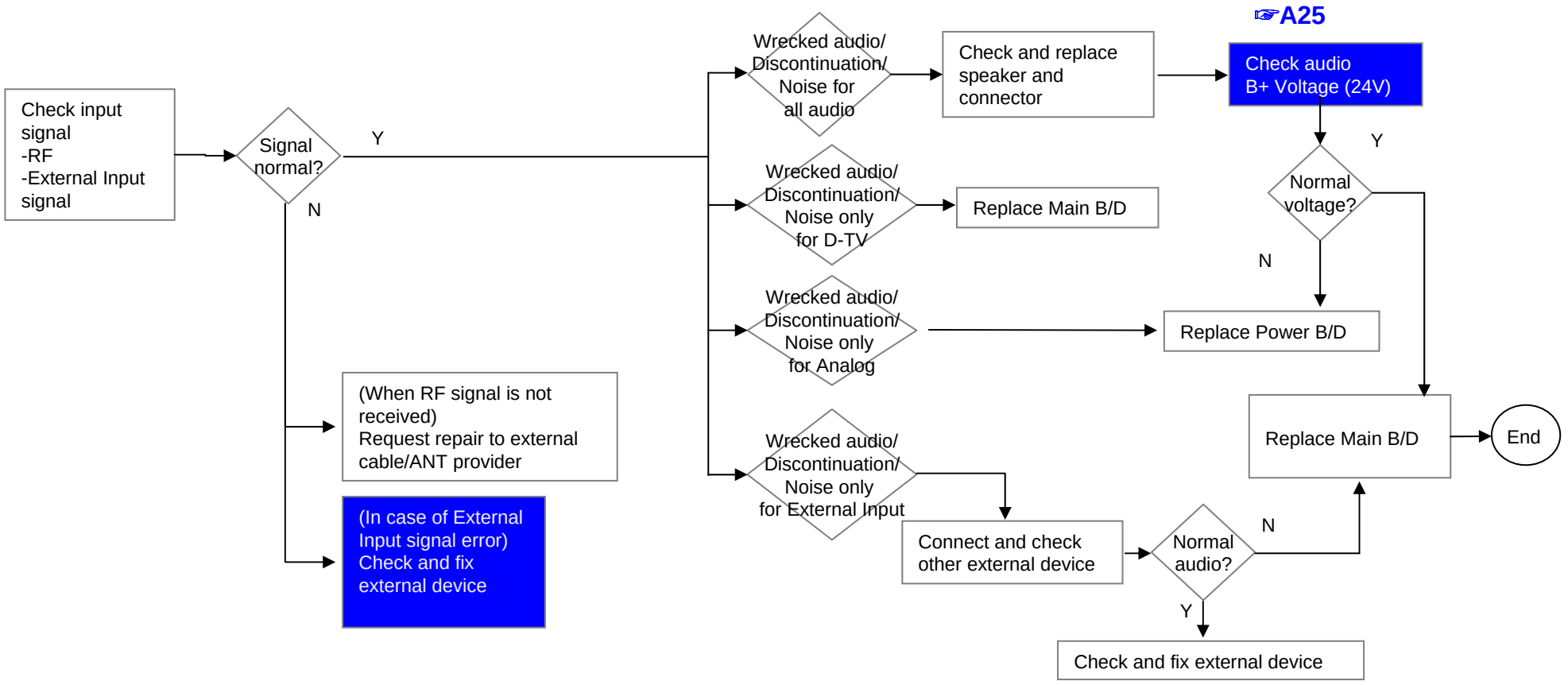
→ abnormal audio/discontinuation/noise is same after "Check input signal" compared to No audio



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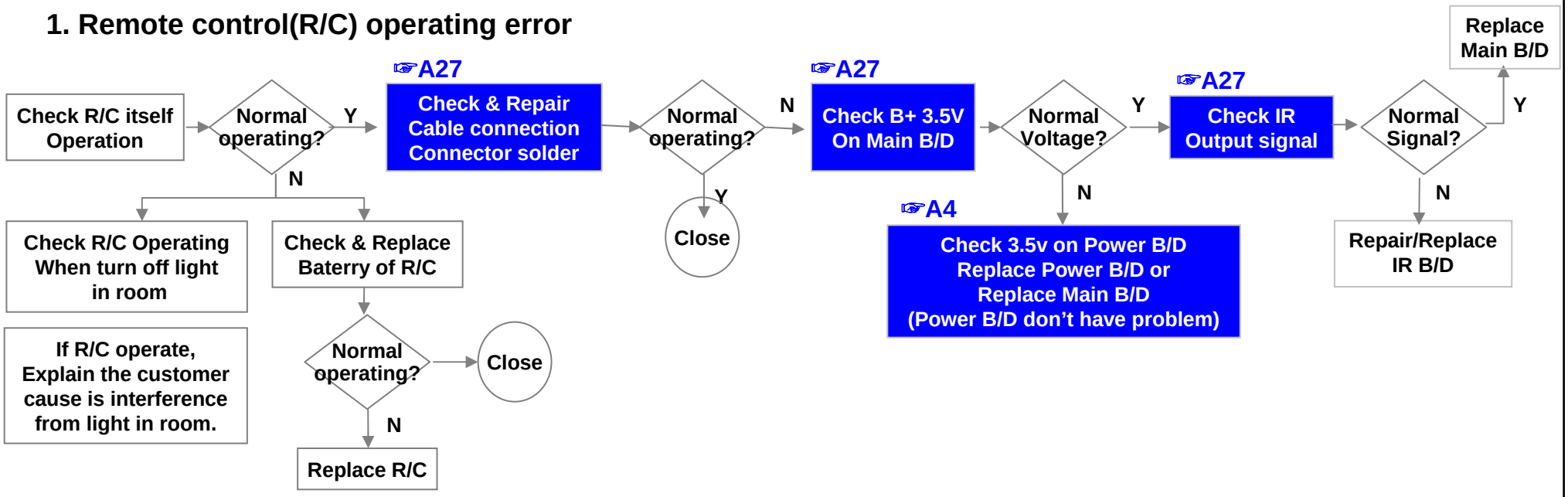
1. Remote control(R/C) operating error



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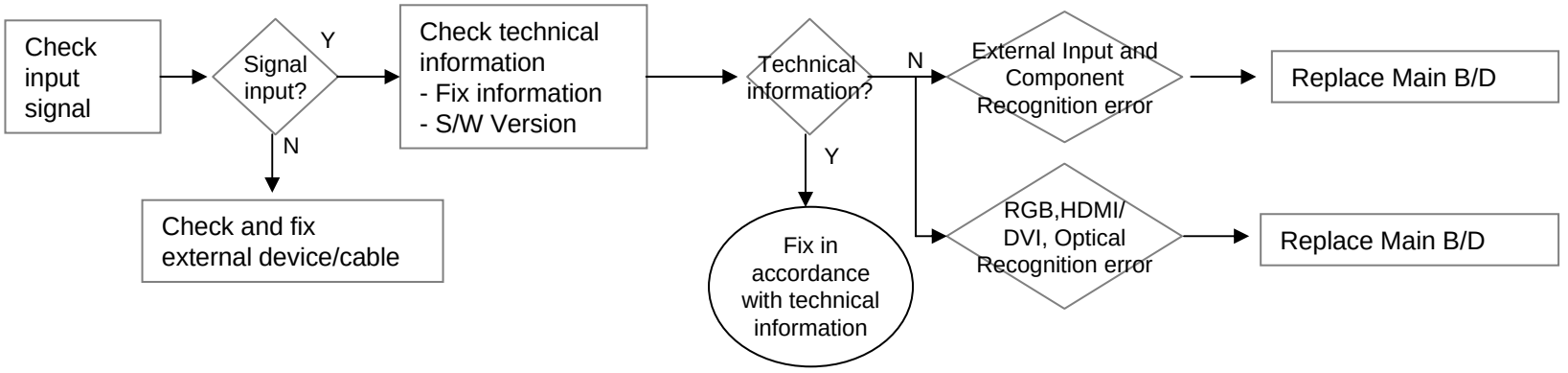
LCD TV	Error symptom	D. Function error	Established date	2010. 12 .14	
		External device recognition error	Revised date		11/13



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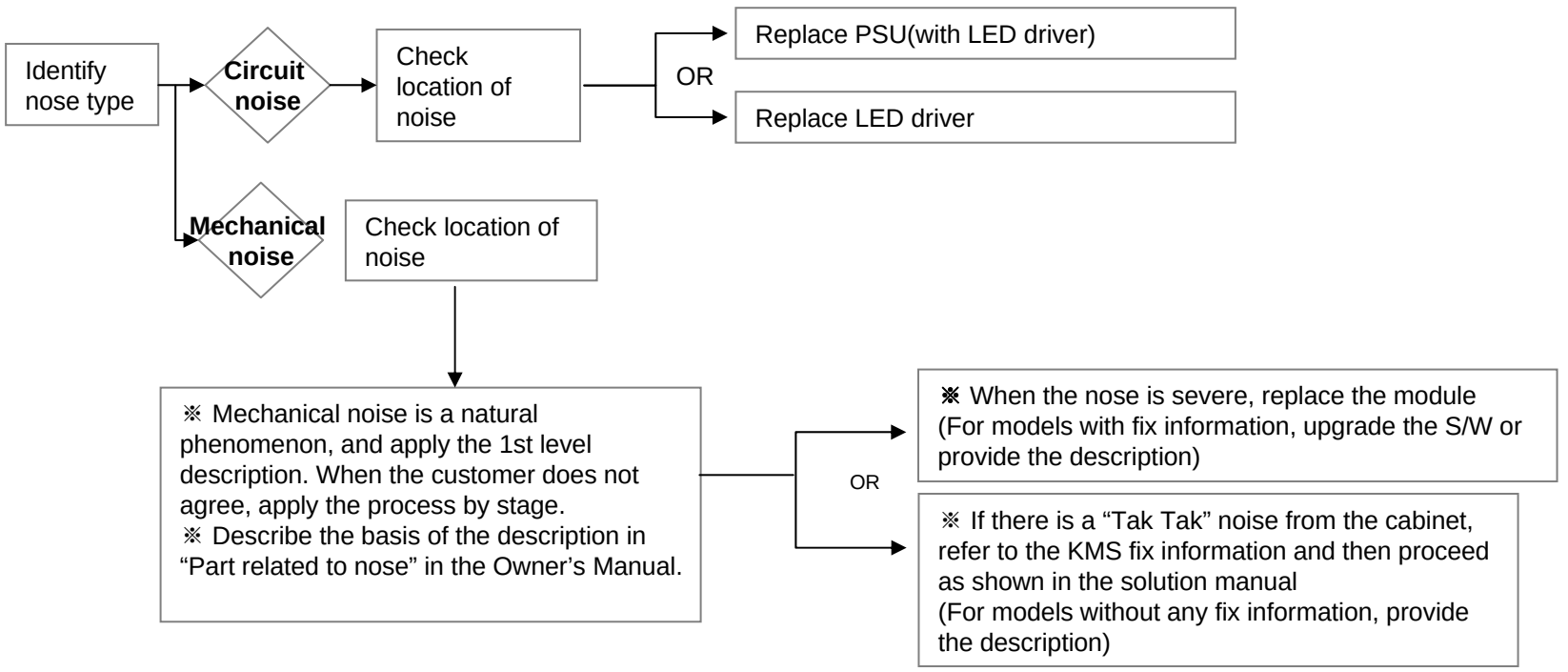

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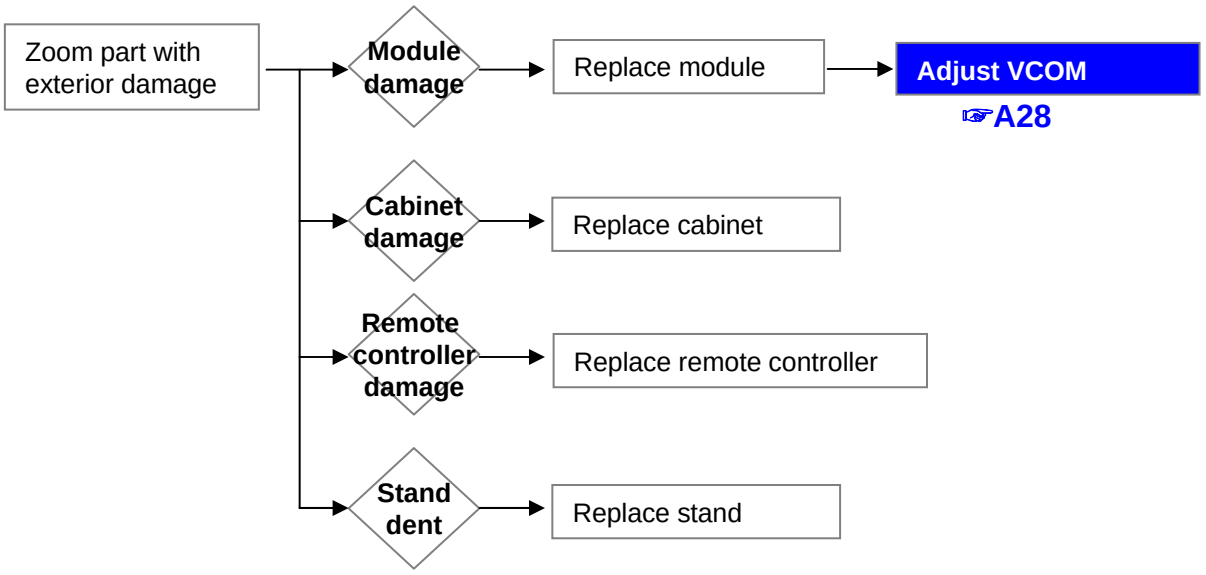
LCD TV	Error symptom	F. Exterior defect	Established date	2010. 12 .14	
		Exterior defect	Revised date		13/13



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Contents of LCD TV Standard Repair Process Detail Technical Manual

Continued from previous page

No.	Error symptom	Content	Page	Remarks
21	B. Power error_No power	Check front display LED	A17	
22		Check power input Voltage & ST-BY 5V	A18	
23		Checking method when power is ON	A19	
24		POWER BOARD voltage measuring method	A4	
25				
26	B. Power error_Off when on, off while viewing	POWER OFF MODE checking method	A22	
27	B. Power error_Off when on, off while viewing	POWER BOARD PIN voltage checking method	A19	
28	C. Audio error_No audio/Normal video	Checking method in menu when there is no audio	A24	
29		Voltage and speaker checking method when there is no audio	A25	
30	C. Audio error_Wrecked audio/discontinuation	Voltage and speaker checking method in case of audio error	A25	
31	D. Function error_ No response in remote controller, key error	Remote controller operation checking method	A27	
32	D. VCOM Adjustment	Sequence of the Vcom adjustment	A28	

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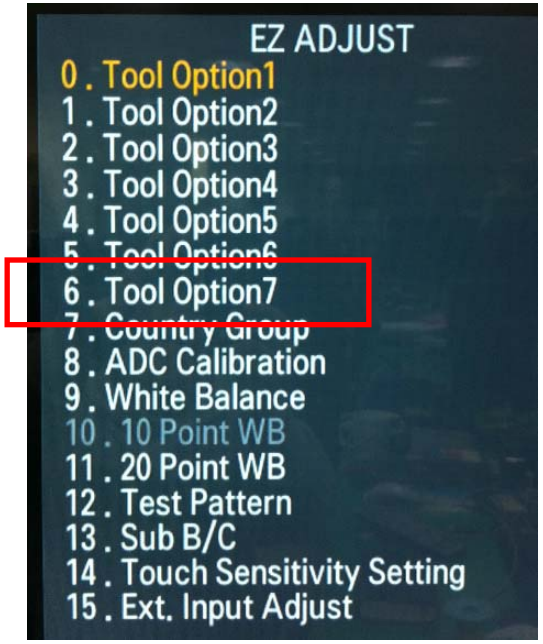
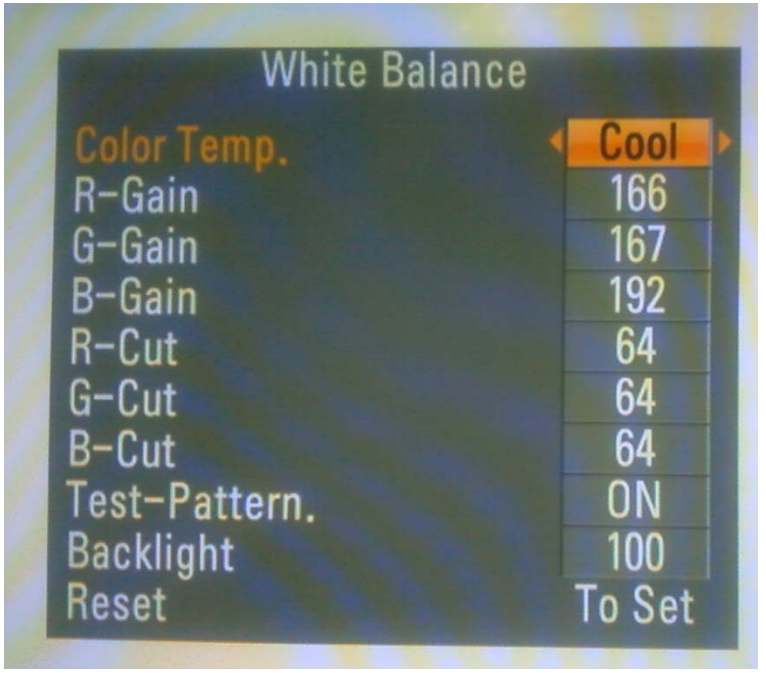
LCD TV	Error symptom	A. Video error_No video/Normal audio	Established date	2010. 12 .14	
	Content	Check White Balance value	Revised date		A4

<ALL MODELS>





Entry method

1. Press the ADJ button on the remote controller for adjustment.

2. Enter into White Balance of item 7.

3. After recording the R, G, B (GAIN, Cut) value of Color Temp (Cool/Medium/Warm), re-enter the value after replacing the MAIN BOARD.

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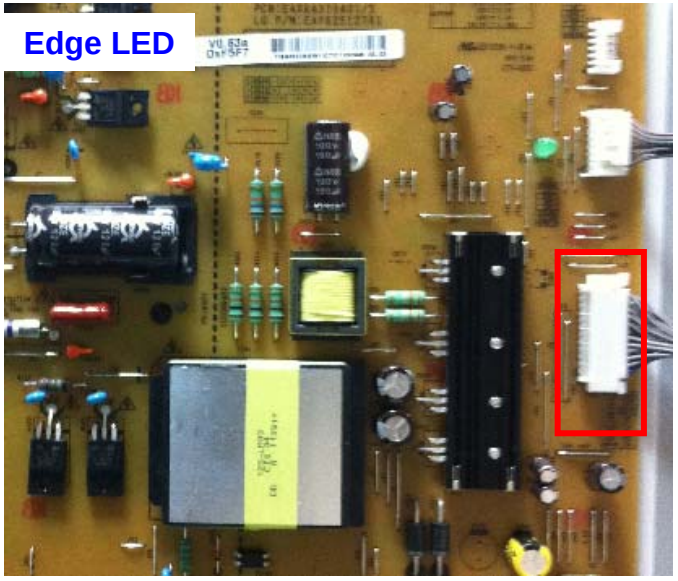
LCD TV	Error symptom	A. Video error_No video/ Audio	Established date	2010. 12 .14	
	Content	Power Board voltage measuring method	Revised date		A5



Check the DC 24V, 12V, 3.5V.

24 Pin (Power Board ↔ Main Board)			
SMAW200-H24S (YEONHO)			
1	Power on	2	24V
3	24V	4	24V
5	GND	6	GND
7	GND	8	GND
9	3.5V	10	3.5V
11	3.5V	12	3.5V
13	GND	14	GND
15	GND	16	GND
17	12V	18	Inverter On/off
19	12V	20	Lamp : A-Dim LED : N.C
21	12V	22	PWM Dim #1
23	GND/P_DIM2 • Lamp SCANNING Model : PWM Dim #2	24	Error-out

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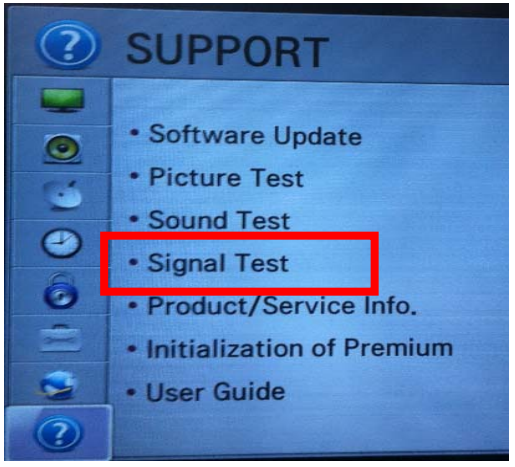
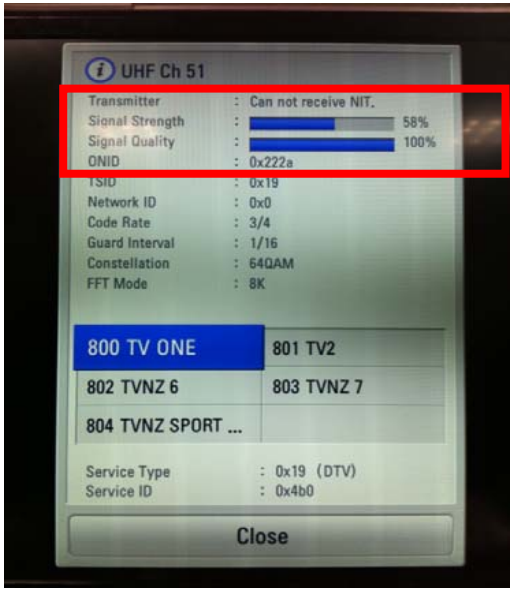
Standard Repair Process Detail Technical Manual

LCD TV	Error symptom	A. Video error_Video error, video lag/stop	Established date	2010. 12 .14	
	Content	TUNER input signal strength checking method	Revised date		A6

<ALL MODELS>





MENU -→ Set up → support -→ signal test -→ select channel

When the signal is strong, use the attenuator (-10dB, -15dB, -20dB etc.)

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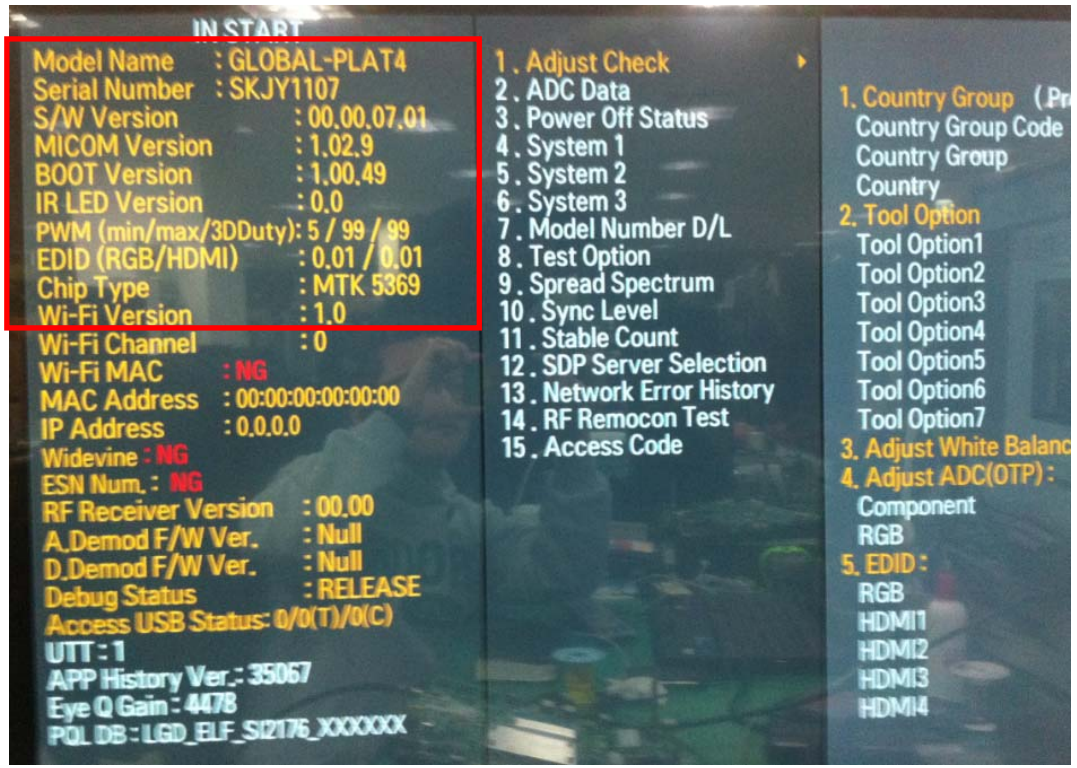
Standard Repair Process Detail Technical Manual

LCD TV	Error symptom	A. Video error_Video error, video lag/stop	Established date	2010. 12 .14	
	Content	LCD-TV Version checking method	Revised date		A7

<ALL MODELS>

1. Checking method for remote controller for adjustment

Version



Press the IN-START with the remote controller for adjustment

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LCD TV	Error symptom	A. Video error _Vertical/Horizontal bar, residual image, light spot	Established date	2010. 12 .14	
	Content	LCD TV connection diagram (1)	Revised date		A8

<ALL MODELS>

As the part connecting to the external input, check the screen condition by signal

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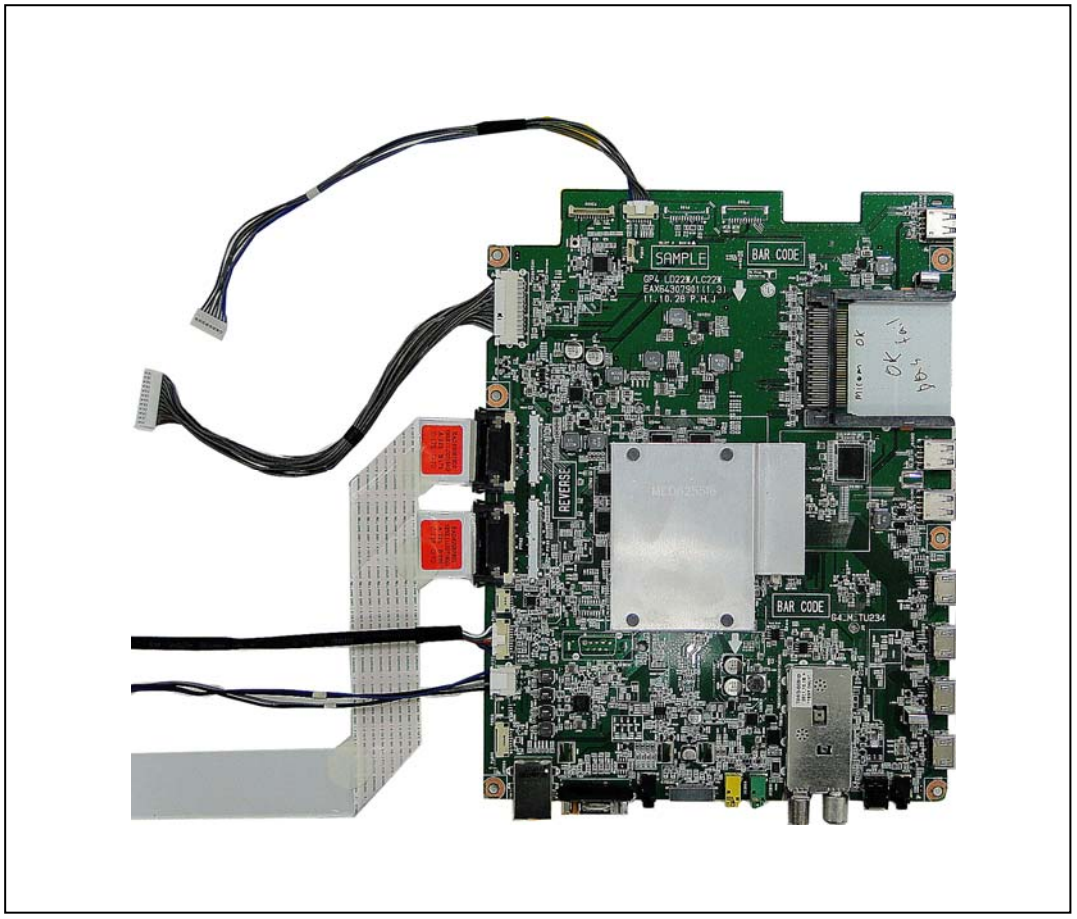
Standard Repair Process Detail Technical Manual

LCD TV	Error symptom	A. Video error_Video error, video lag/stop	Established date	2010. 12 .14	
	Content	TUNER checking part	Revised date		A9

<ALL MODELS>



Checking method:
1. Check the signal strength or check whether the screen is normal when the external device is connected.
2. After measuring each voltage from power supply, finally replace the MAIN BOARD.

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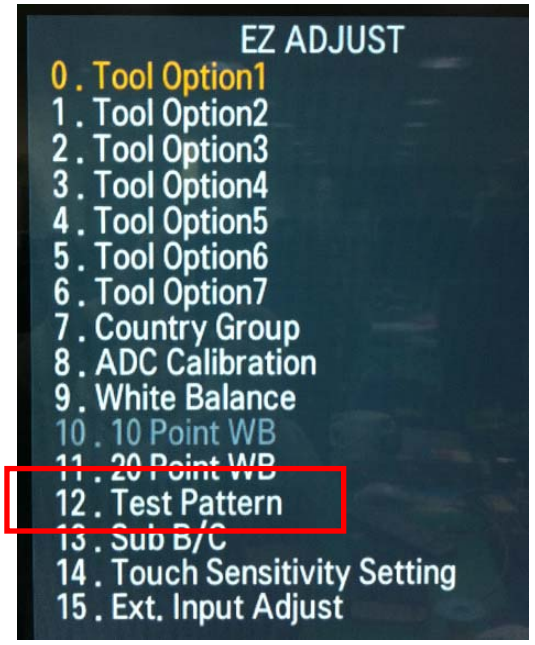
LCD TV	Error symptom	A. Video error_Color error	Established date	2010. 12 .14	
	Content	Adjustment Test pattern - ADJ Key	Revised date		A12



You can view 6 types of patterns using the ADJ Key

Checking item : 1. Defective pixel 2. Residual image 3. MODULE error (ADD-BAR,SCAN BAR..)
4.Video error (Classification of MODULE or Main-B/D!)

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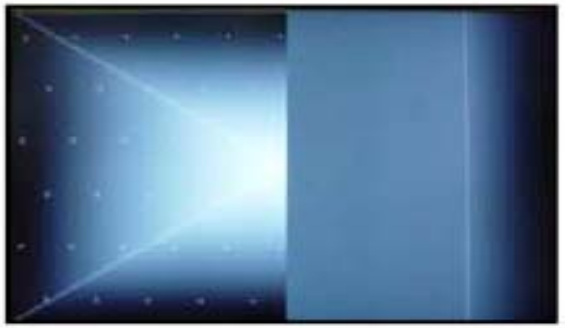
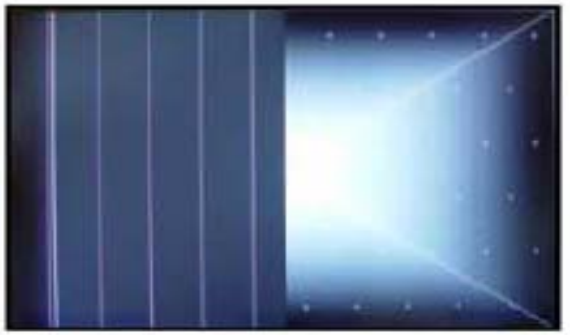
Appendix : Exchange T-Con Board (1)

Solder defect, CNT Broken

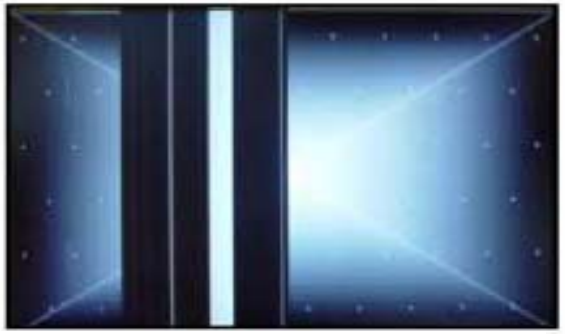


Solder defect, CNT Broken

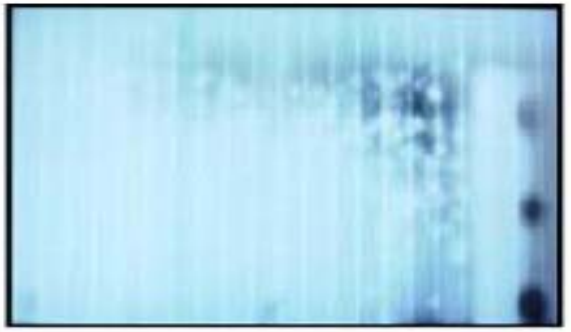


Solder defect, CNT Broken

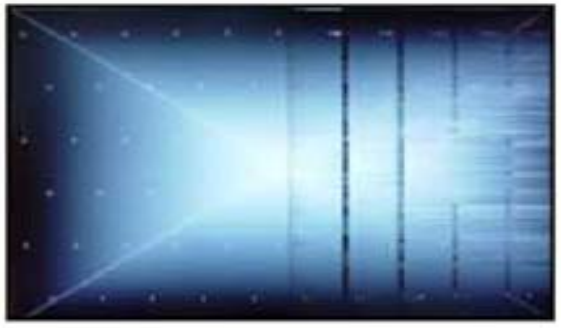
Solder defect, CNT Broken



Solder defect, CNT Broken



Abnormal Power Section



Solder defect, Short/Crack

Abnormal Power Section

Solder defect, Short/Crack

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Appendix : Exchange T-Con Board (2)

Abnormal Power Section

Abnormal Power Section

Solder defect, Short/Crack

Solder defect, Short/Crack

Fuse Open, Abnormal power section

Abnormal Display

GRADATION

Noise

GRADATION

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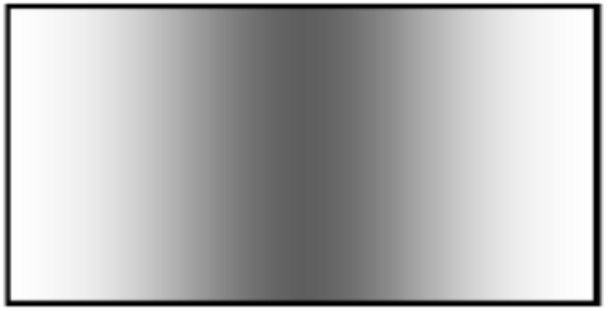
Appendix : Exchange PSU(LED driver)

No Light

Dim Light

Dim Light



Dim Light

No picture/Sound Ok

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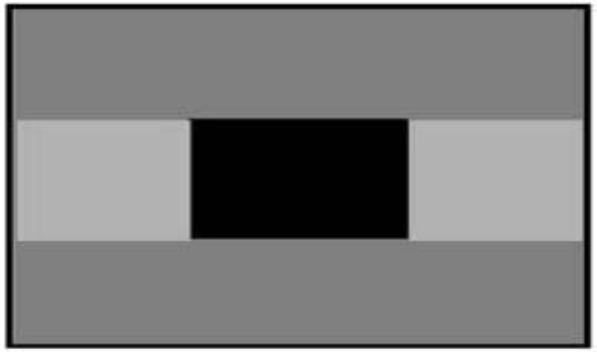
Appendix : Exchange the Module (1)

Panel Mura, Light leakage

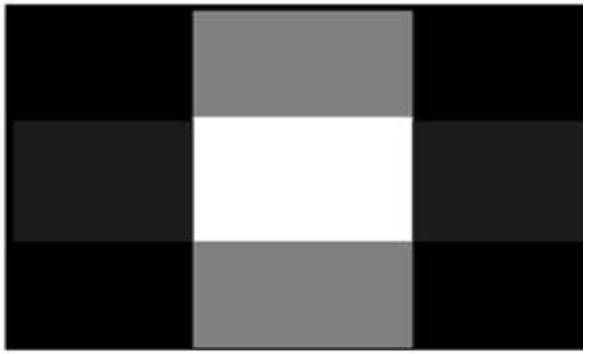
Panel Mura, Light leakage

Press damage



Crosstalk

Press damage



Crosstalk

Press damage

Un-repairable Cases

In this case please exchange the module.

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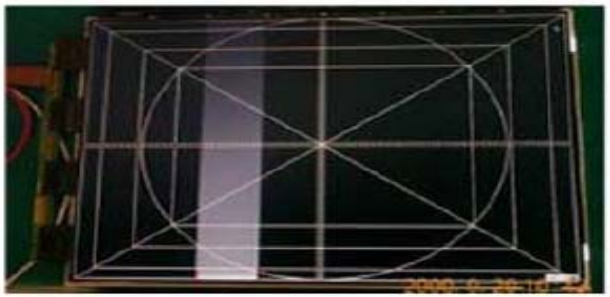
Appendix : Exchange the Module (2)



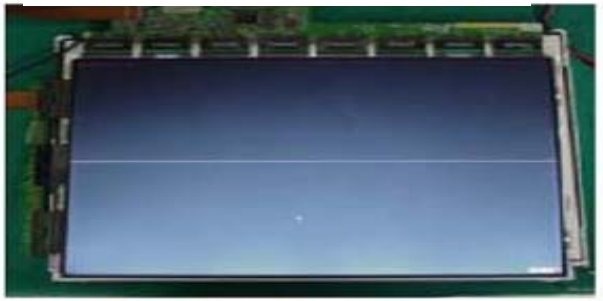
Vertical Block
Source TAB IC Defect

Vertical Line
Source TAB IC Defect

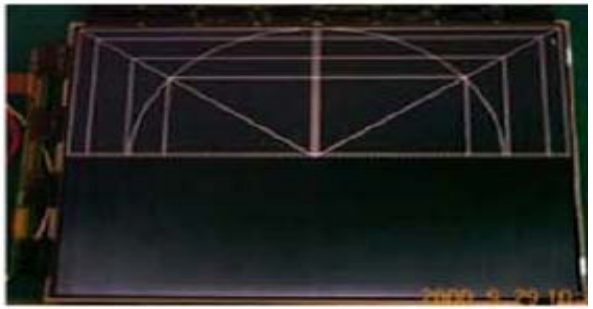
Vertical Block
Source TAB IC Defect

Horizontal Block
Gate TAB IC Defect

Horizontal Block
Gate TAB IC Defect



Horizontal line
Gate TAB IC Defect



Horizontal Block
Gate TAB IC Defect

Un-repairable Cases

In this case please exchange the module.

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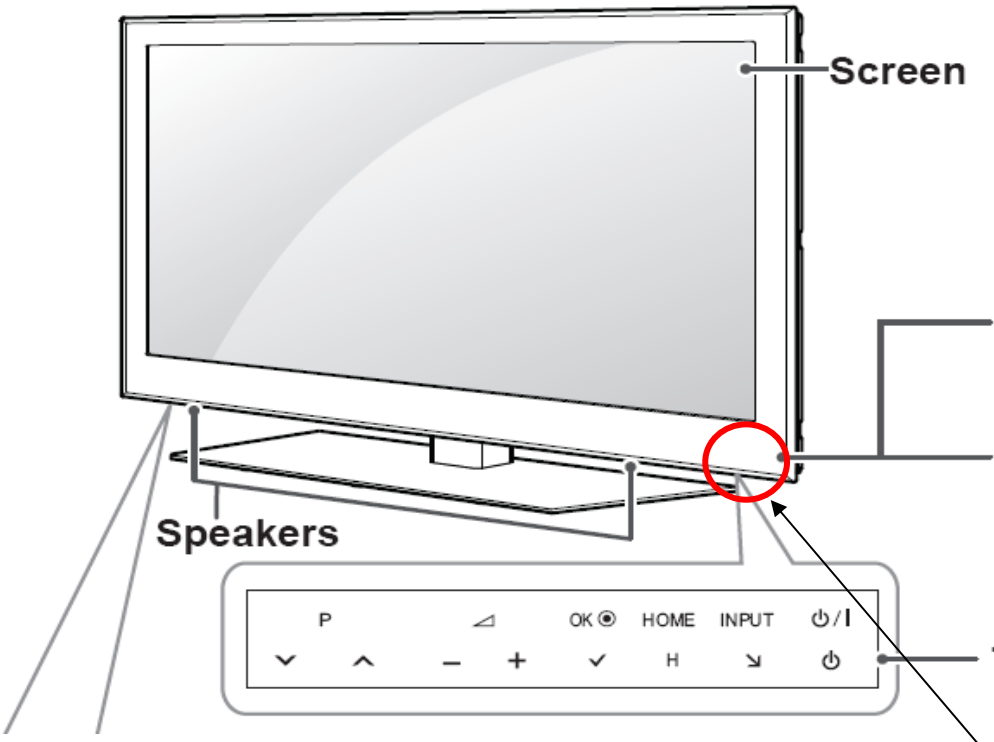
Standard Repair Process Detail Technical Manual

LCD TV	Error symptom	B. Power error _No power	Established date	2010. 12 .14	
	Content	Check front display LED	Revised date		A17



Front LED control :
Menu → Option → Power Indicator → Standby light ON

ST-BY condition: Red
Power ON condition: white

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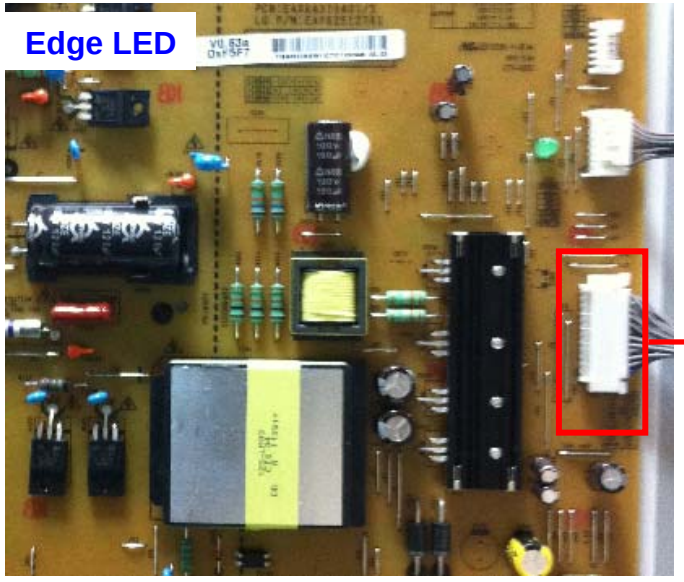
Standard Repair Process Detail Technical Manual

LCD TV	Error symptom	B. Power error _No power	Established date	2010. 12 .14	
	Content	Check power input voltage and ST-BY 5V	Revised date		A18

For ’10 models, there is no voltage out for st-by purpose.
When st-by, only 3.5V is normally on.



Check the DC 20V/24V, 12V, 3.5V.

24 Pin (Power Board ↔ Main Board)			
SMAW200-H24S (YEONHO)			
1	Power on	2	24V
3	24V	4	24V
5	GND	6	GND
7	GND	8	GND
9	3.5V	10	3.5V
11	3.5V	12	3.5V
13	GND	14	GND
15	GND	16	GND
17	12V	18	Inverter On/off
19	12V	20	Lamp : A-Dim LED : N.C
21	12V	22	PWM Dim #1
23	GND/P_DIM2 • Lamp SCANNING Model : PWM Dim #2	24	Error-out

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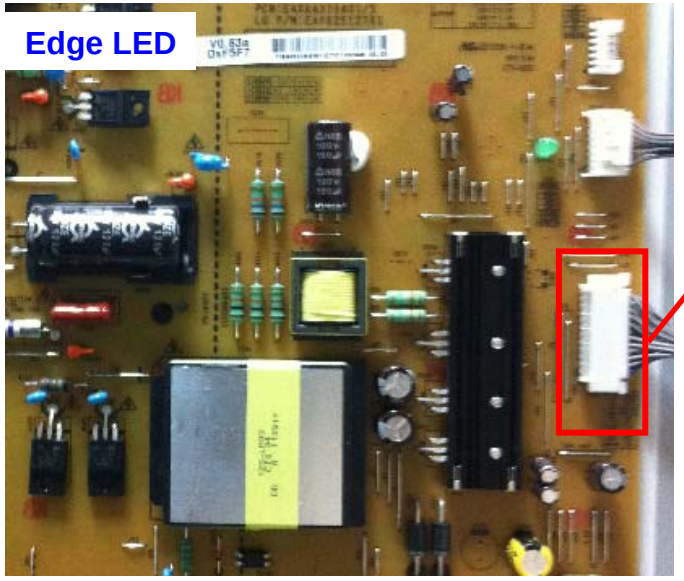
Standard Repair Process Detail Technical Manual

LCD TV	Error symptom	B. Power error _No power	Established date	2010. 12 .14	
	Content	Checking method when power is ON	Revised date		A19

Check “power on” pin is high



24 Pin (Power Board ↔ Main Board)			
SMAW200-H24S (YEONHO)			
1	Power on	2	24V
3	24V	4	24V
5	GND	6	GND
7	GND	8	GND
9	3.5V	10	3.5V
11	3.5V	12	3.5V
13	GND	14	GND
15	GND	16	GND
17	12V	18	Inverter On/off
19	12V	20	Lamp : A-Dim LED : N.C
21	12V	22	PWM Dim #1
23	GND/P_DIM2 • Lamp SCANNING Model : PWM Dim #2	24	Error-out

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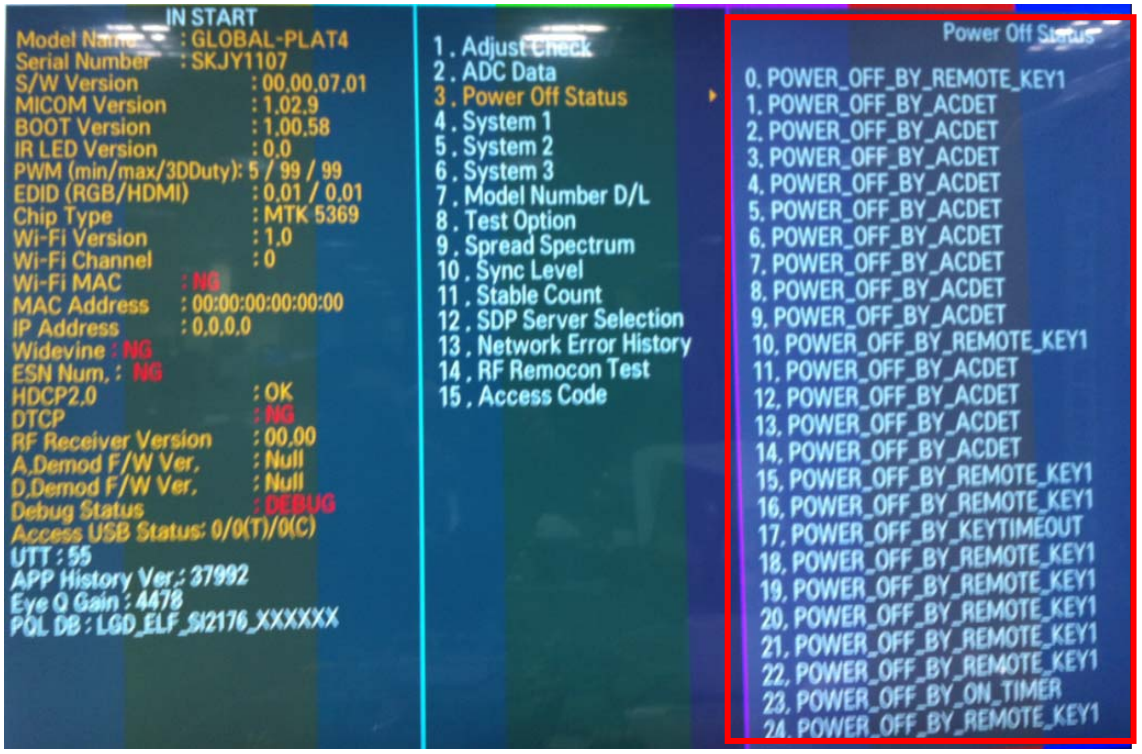
Standard Repair Process Detail Technical Manual

LCD TV	Error symptom	B. Power error _Off when on, off whiling viewing	Established date	2010. 12 .14	
	Content	POWER OFF MODE checking method	Revised date		A22

<ALL MODELS>



Entry method

1. Press the IN-START button of the remote controller for adjustment

2. Check the entry into adjustment item 3

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LCD TV	Error symptom	C. Audio error_No audio/Normal video	Established date	2010. 12 .14	
	Content	Checking method in menu when there is no audio	Revised date		A24

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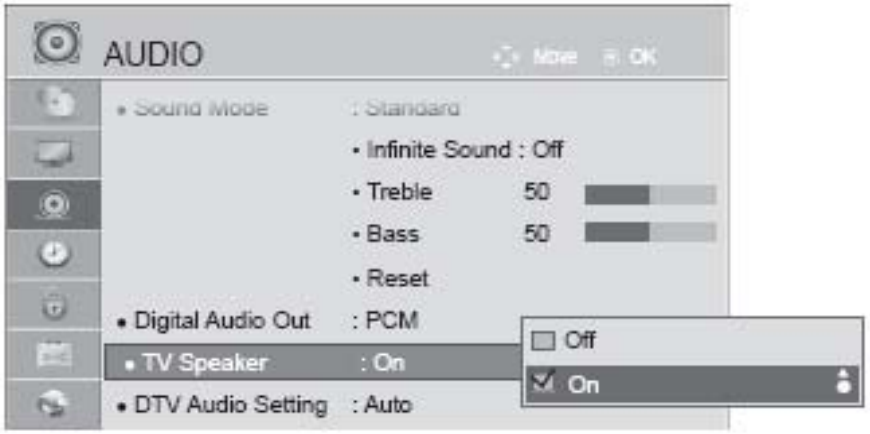

Checking method

1. Press the MENU button on the remote controller
2. Select the AUDIO function of the Menu
3. Select TV Speaker from Off to On

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Standard Repair Process Detail Technical Manual

LCD TV	Error symptom	C. Audio error_No audio/Normal video	Established date	2010. 12 .14	
	Content	Voltage and speaker checking method when there is no audio	Revised date		A25

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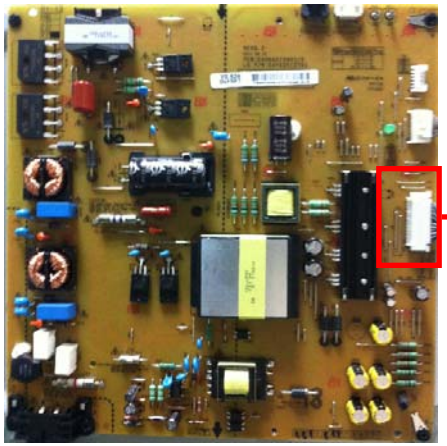
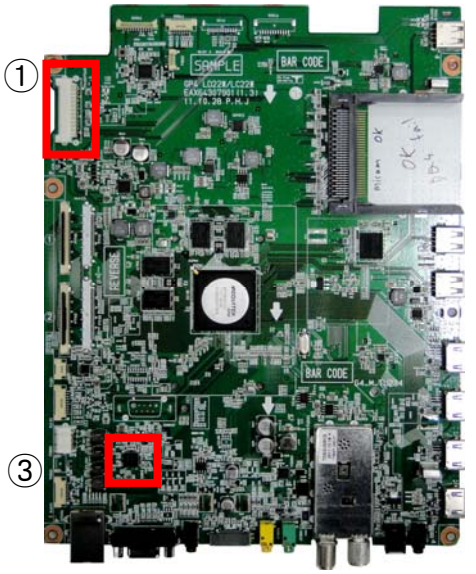


24 Pin (Power Board ↔ Main Board)			
SMAW200-H24S (YEONHO)			
1	Power on	2	20V (24V)
3	20V (24V)	4	20V (24V)
5	GND	6	GND
7	GND	8	GND
9	3.5V	10	3.5V
11	3.5V	12	3.5V
13	GND	14	GND
15	GND	16	GND
17	12V	18	Inverter On/off
19	12V	20	Lamp : A-Dim LED : N.C
21	12V	22	PWM Dim #1
23	GND/P_DIM2	24	Error-out



Checking order when there is no audio

① Check the contact condition of or 24V connector of Main Board

② Measure the 24V input voltage supplied from Power Board
(If there is no input voltage, remove and check the connector)

③ Connect the tester RX1 to the speaker terminal and if you hear the Chik Chik sound when you touch the GND and output terminal, the speaker is normal.

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LCD TV	Error symptom	D. Function error_ No response in remote controller, key error	Established date	2010. 12 .14	
	Content	Remote controller operation checking method	Revised date		A27

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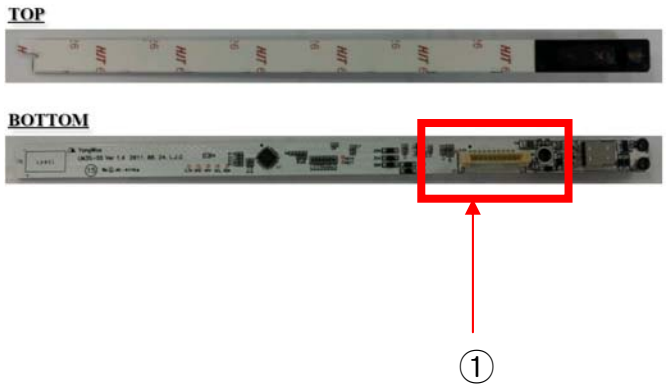

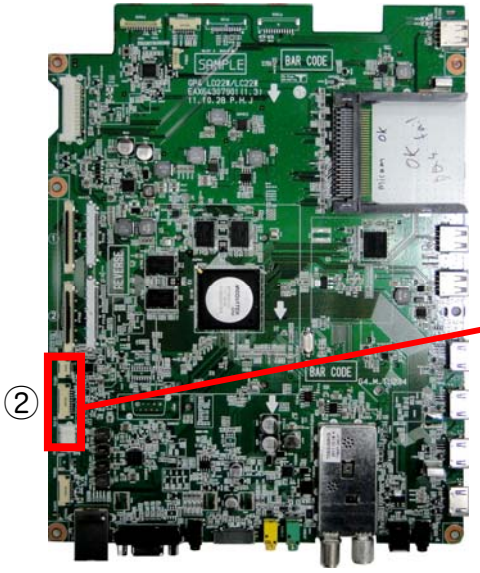

P4102	
1	SCL
2	SDA
3	GND
4	KEY1
5	KEY2
6	St 3.5V
7	GND
8	RED_LED
9	IR
10	GND

③

④

Checking order

1, 2. Check IR cable condition between IR & Main board.
3. Check the st-by 3.3V on the terminal 6.
4. When checking the Pre-Amp when the power is in ON condition, it is normal when the Analog Tester needle moves slowly, and defective when it does not move at all.

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Standard Repair Process Detail Technical Manual

LCD TV	Error symptom	D. VCOM Adjustment	Established date	2010. 12 .14	
	Content	Sequence of the Vcom adjustment	Revised date		A28

1. Case

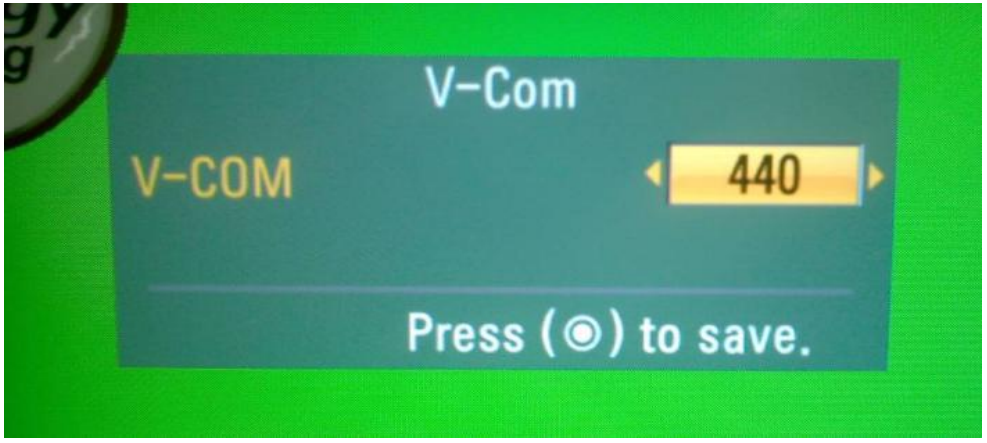
■ LCD module change
■ T-Con board change

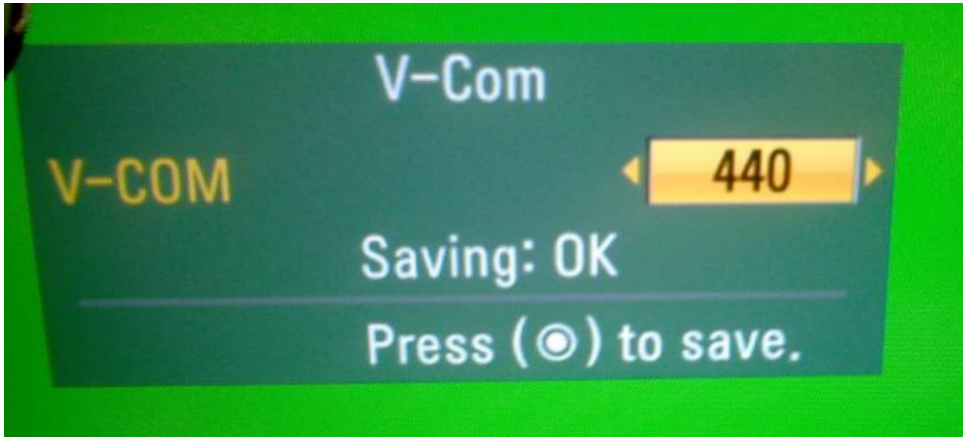
2. Equipment

■ Service Remote controller

3. Adjust sequence

■ Press the ‘adj’ key
■ select V-COM
■ As pushing the right or the left button on the remote controller, And find the V-COM value Which is no or minimized the Flicker.
(If there is no flicker at default value, Press the exit key and finish the VCOM adjustment.)
■ Push the OK key to store the value. Then the message “Saving OK” is pop.
■ Press the exit key to finish V-COM adjustment.





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